List of stack component suppliers

VDMA

11.11.2021

Contents

Chapter 1

Introduction

1.1 VDMA

The German Mechanical Engineering Industry Association (VDMA) represents around 3300 companies in the mechanical and plant engineering sector. The Fuel Cell Working Group supports arround 70 leading manufacturers and suppliers of fuel cells in the expansion of the industrial network and in the political representation of interests. To this end, technical solutions for the optimization and cost reduction of fuel cell systems and components as well as for the establishment of series production are being developed in project groups.

1.2 Disclaimer

The contents of this supplier directory have been carefully researched and compiled. VDMA accepts no responsibility for the correctness and completeness of the information or for any changes that may occur in the meantime.

Chapter 2

BPP

2.1 Metallic BPP supplier

2.1.1 AJUSA

Company Name:	AJUSA
Adress:	Parque Empresarial Ajusa. Calle 1 n°1 02006 Albacete Spain
Telephone number:	+34 967 216212
Email:	jmgregorio@ajusa.es
Website:	https://ajusa.es/
Responsible Person:	Jose Manuel Gregorio

AJUSA Hydrogen Technologies focuses its experience since 2003 in the development of fuel cells

type PEM (PEMFC) and its applications for backup systems, mCHP, fuel cell module for automotive and gen sets in general.

Internal development and manufacture of Stacks, bipolar plates and seals.

Hydrogen Refuellin Station of 350 bar, in service since 2012

Several development projects with public grants from the government of Spain

Manufacturing Tech. for BPP:

-Stamping and laser cutting machines.

-Cold-pressing & Hot-pressing

-Milling.

-Gluing

Current project: Max Size BP: 300x450 mm

We offer the following:

- Metallic BPP
- BPP made of compound

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: 300x350 mm.

2.1.2 Borit NV

Company Name:	Borit NV
Adress:	Lammerdries 18e 2440 Geel Belgium
Telephone number:	+32 491 90 46 60
Email:	hendrik.geysen@borit.be
Website:	www.borit.be
Responsible Person:	Hendrik Geysen

Borit NV is an enterprise specialized in the industrial manufacturing of metal plates and assemblies for fuel cells and electrolyzers. Since 2010, technologies like HydrogateTM forming, laser-cutting, laser-welding and many others have been developed in house in order to establish leading manufacturing processes for metal bipolar plates. We support customers from the early design phase over prototyping to series production. For this we use different technologies and capabilities throughout the ramp-up in order to offer the optimal balance between development flexibility, cost and time-to-market. Borit' array of technologies enables fast product development cycles combined with unique cost advantages. This to satisfy at best the customer needs and contribute to the green energy industry.

We offer the following:

- Metallic BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: Current capacity: +2.5 mio PCS/yr, investments to increase largely ongoing.

Our minimum order is: Small orders possible (<100) , significant investments are however required.

2.1.3 Dana Incorporated - REINZ-Dichtungs-GmbH

Company Name:	Dana Incorporated - REINZ-Dichtungs-GmbH
Adress:	Reinzstrasse 3-7 89233 Neu-Ulm Germany
Telephone number:	+49 (0)731 7046 668
Email:	robert.blersch@dana.com
Website:	www.reinz.com/www.dana.com
Responsible Person:	Robert Blersch

Dana is a world leader in providing power-conveyance and energy-management solutions that are engineered to improve the efficiency, performance, and sustainability of light vehicles, commercial vehicles, and off-highway equipment. Enabling the propulsion of conventional, hybrid, and electric-powered vehicles, Dana equips its customers with critical drive and motion systems; electrodynamic technologies; and thermal, sealing, and digital solutions.

Moreover, Dana is one of the pioneers in the research and development of fuel cell technology. Original equipment manufacturers around the world are already using Dana's bipolar plates in fuel-cell technology as an energy source or range extender in mobile applications.

We offer the following:

- Metallic BPP

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: approx. 200x400.

Our minimum order is: 500 Parts.

2.1.4 SITEC Industrietechnologie GmbH

Company Name:	SITEC Industrietechnologie GmbH
Adress:	Bornaer Str. 192 09114 Chemnitz GERMANY
Telephone number:	+49 371 4708 241
Email:	info@sitec-technology.de
Website:	https://www.sitec-technology.de/
Responsible Person:	Martin Florstedt

For more than 30 years, SITEC has been a globally respected system supplier for automated high-tech production systems and a partner for the series production of assemblies and precision parts. We rely on proven processes such as laser material processing and automated assembly - focused on process reliability, cost-effectiveness and energy efficiency.

Since 2006 SITEC has been installing bipolar plate production equipment for industrial manufacturing and research. We offer scalable production systems worldwide, ranging from manual to fully automated systems.

Since 2012, SITEC manufactures bipolar plates (PEM, SOFC, SOEC) according to its customers fuel cell design. SITEC welded bipolar plates can be found in hydrogen-based electric drives, in stationary fuel cells or in electrolysers.

We offer the following:

- Metallic BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: 350 * 700 mm.

2.1.5 Weil Technology GmbH

Company Name:	Weil Technology GmbH
Adress:	Neuenburger Straße 23 D-79379 Müllheim Germany
Telephone number:	+49 7631 1809116
Email:	h.liebhart@weil-technology.com
Website:	www.weil-technology.com
Responsible Person:	Harald Liebhart

Since 1987 Weil Technolgy is focused on machines and systems with innovative laser, clamping and automation technologies. In addition to stand-alone machines, we also provide turnkey systems including stable production processes. In other words, machine and process from a single source.

- First FuelCell customer projects in 2019
- Plant technology for laserwelding of BPP
- Production lines for laserwelding of BBP
- Experience on materials 1.4404 and titan

- Special machines with laser welding or laser cutting applications

- Assisted pre-engineering of customer components for laser processing
- Engineering clamping technology and tooling

We offer the following:

- Metallic BPP

We offer products for the following fuel cell types: LT-PEM and HT-PEM. Our products are used in the following applications:

- Automotive
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: 500mm x 350mm, other dimension on request.

2.2 Graphite based BPP supplier

2.2.1 AJUSA

Company Name:	AJUSA
Adress:	Parque Empresarial Ajusa. Calle 1 n°1 02006 Albacete Spain
Telephone number:	+34 967 216212
Email:	jmgregorio@ajusa.es
Website:	https://ajusa.es/
Responsible Person:	Jose Manuel Gregorio

AJUSA Hydrogen Technologies focuses its experience since 2003 in the development of fuel cells

type PEM (PEMFC) and its applications for backup systems, mCHP, fuel cell module for automotive and gen sets in general.

Internal development and manufacture of Stacks, bipolar plates and seals.

Hydrogen Refuellin Station of 350 bar, in service since 2012

Several development projects with public grants from the government of Spain

Manufacturing Tech. for BPP:

-Stamping and laser cutting machines.

-Cold-pressing & Hot-pressing

-Milling.

-Gluing

Current project: Max Size BP: 300x450 mm

We offer the following:

- Metallic BPP
- BPP made of compound

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: 300x350 mm.

2.2.2 Blue World Technologies

Company Name:	Blue World Technologies
Adress:	Lavavej 16 9220 Aalborg Øst Denmark
Telephone number:	+45 29 70 74 88
Email:	mfj@blue.world
Website:	https://www.blue.world/
Responsible Person:	Mads Friis Jensen

Blue World Technologies is a leading provider of high-temperature fuel cell technology, components, and systems. With more than 20 years of experience in research, development and systems engineering, Blue World Technologies develops and manufactures HT-PEMFC systems for automotive, heavy-duty, and stationary applications.

The primary fuel for Blue World Technologies' FC technology is pure methanol, offering high autonomy, superior energy density, short refueling time and high performance. With extensive focus on system design and thermal integration the FC technology operates with high electrical efficiency ensuring a competitive fuel economy while eliminating all harmful emissions and providing green CO2-neutral power generation.

We offer the following:

- BPP made of compound

We offer products for the following fuel cell types: HT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Stationary

We offer seal on BPP.

The maximum we can offer is: Manufactures BPPs for own HT-PEMFC stack production. Size to be discussed. .

Our minimum order is: Min. volume depends on type (standard or customized).

2.2.3 Centroplast Engineering Plastics GmbH

Company Name:	Centroplast Engineering Plastics GmbH
Adress:	Unterm Ohmberg 1 34431 Marsberg Germany
Telephone number:	+49 2992 9704 716 +49 171 2969621
Email:	Holger.kranke@centroplast.de
Website:	www.centroplast.de
Responsible Person:	Holger Kranke

- Main competence is extrusion of engineering plastics, machining and assembly
- development and production of compounds inhouse
- extrusion process of BPP for applications in Redox Flow Batteries established
- series production of BPP will start middle of 2021
- entire process chain is established: compounding, extrusion, machining, testing
- sub-assemblies, functional-integration possible on request
- cooperation with several institutes
- projects for production of NTPEM and HTPEM applications will be launched 2021
- project partners are welcome

We offer the following:

- BPP made of compound
- Compounds for making BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: Length3000mm X Width1200mm X Thickness8mm.

Our minimum order is: 1.

2.2.4 Eisenhuth GmbH & Co. KG

Company Name:	Eisenhuth GmbH & Co. KG
Adress:	Friedrich-Ebert-Str. 203 37520 Osterode am Herz Germany
Telephone number:	+49 5522 90670
Email:	info@eisenhuth.de
Website:	www.eisenhuth.de
Responsible Person:	Dr. Thorsten Hickmann

Eisenhuth is an innovative companny that skilfully combines tradition with modernity. It has 3 core competences: Mould making, series production for thermoplastice, rubber, silicones and Fuel cell components. Eisenhuth is at the moment one large manufacturer of graphitic bipolar plates and Fuel clel gaskets n Europe. These products are not only distributed in EUrope, but all over the world. Moreover, the company produces Components for Electrolyzers on alkaline and PEM-Basis

The products are suitable for LT PEM, HT PEM and Methanol Fuel cells.

The company has also extended facilities for testing and analysis. ANd some test benches for fuel cells.

We offer the following:

- BPP made of compound
- BPP made of graphite
- Compounds for making BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: 500x1500.

Our minimum order is: 1.

2.2.5 Ensinger GmbH

Company Name:	Ensinger GmbH
Adress:	Rudolf-Diesel-Strasse 8 71154 Nufringen Germany
Telephone number:	+49 7032 819 0
Email:	info.de@ensingerplastics.com
Website:	https://www.ensingerplastics.com/de-de/ueber-uns
Responsible Person:	Mr. Joachim Reidenbach - Joachim.Reidenbach@ensingerplastics.com,Tel.: +49 7032 819 238

The Ensinger Group is engaged in the development, manufacturing and sale of compounds, semi-finished materials, composites, technical parts and profiles made of engineering and high-performance plastics. Further development of proven production techniques, new applications and international expansion have earned this family-owned enterprise a place among the leaders in its field.

We have more than 10 years experience in the development and production of fuel cell material. With the Brand Name TECACOMP HTE we are able to sale PP and PPS Compounds. Depending on the polymer used, the degree of filling and the targeted component size, the formulas are suitable either for processing by injection moulding or compression moulding.

We offer the following:

- Compounds for making BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maximum we can offer is: until 1000 Tonnen Compound .

Our minimum order is: 25 Kg Compound.

2.2.6 Entegris GMBH

Company Name:	Entegris GMBH
Adress:	Entegris GmbH HUGO-JUNKERS-RING 5 GEBäUDE 107W 01109 Dresden Germany
Telephone number:	+33 4 76 35 73 21
Email:	poco.europe@entegris.com
Website:	https://poco.entegris.com/en/home/our-science/by-industry/energy/fuel-cell.html
Responsible Person:	Guillaume Charlet

GRAPHITE MATERIALS

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We produce a variety of graphite materials that can be used for bipolar plates. The most popular plate material is a pyrolytically sealed graphite (PYC) that is non-porous and does not allow leaking of the cell stack. PYC plates are produced by subjecting machined plates to a proprietary carbon treatment that completely seals the surface. For maximum output, start with the material that offers maximum efficiency.

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PRECISION MACHINING SERVICES

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The high strength and small, uniform microstructure of our graphite makes it possible to machine intricate patterns/channels into the plate to meet the fuel cell design requirements for flow field efficiency up to 0.0005’ ’.

We offer the following:

- BPP made of graphite

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maximum we can offer is: 600x1500mm.

2.2.7 Illuming Power Inc

Company Name:	Illuming Power Inc
Adress:	1030 East Cordova St Vancouver, BC Canada V6A 4A3
Telephone number:	+1-604-210-4382
Email:	mike.joyce@illumingpower.com
Website:	www.illumingpower.com
Responsible Person:	Mike Joyce

Illuming Power develops hydrogen fuel cell technologies, specializing in stack, component and materials design, prototyping, and testing development. We develop technologies that provide a step change improvement in performance and manufactured cost reduction for our clients in the hydrogen fuel cell industry.

We specialize in stack, plate, seal and MEA design; BPP bonding, sealing and test process design; using our expertise in FC fluid, materials and electrochemical design, test and modeling. Our in-house prototype manufacturing, test stations and materials science lab facilitate fundamental materials testing, plate and stack leak testing, and performance testing of single cells (sub-scale and full scale).

We offer the following:

- BPP made of graphite

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling

We offer seal on BPP.

2.2.8 NeoGraf Solutions, LLC

Company Name:	NeoGraf Solutions, LLC
Adress:	11709 Madison Avenue Lakewood,OH 44107 USA
Telephone number:	+44 7770 833755
Email:	kwhite@neograf.com
Website:	https://www.neograf.com
Responsible Person:	Kevin White

NeoGraf Solutions, LLC, a world leader in graphite materials science, has been manufacturing carbon and graphite products for over 140 years in Lakewood, Ohio. Today, the company's high-performance products are used in the proton exchange membrane fuel cell and other advanced battery applications. Formerly part of GrafTech International Ltd., NeoGraf has been developing and manufacturing GrafCell® flexible graphite for the manufacture of PEMFC BPP's for over 20 years. Early development was achieved with Ballard Power Systems as a partner and customer, and today the GrafCell® product line is offered in high volume manufacturing to a diverse global customer base. NeoGraf is ready to support even the most ambitious business plan. For more information, visit www.neograf.com.

We offer the following:

- BPP made of graphite

We offer products for the following fuel cell types: LT-PEM and HT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

2.2.9 SGL Carbon GmbH

Company Name:	SGL Carbon GmbH
Adress:	Werner von Siemensstrasse 18 86405 MEITINGEN Germany
Telephone number:	+49 8271 3360
Email:	fuelcellcomponents@sglcarbon.com
Website:	www.sglcarbon.com
Responsible Person:	Nico Haak

SGL CARBON is active in the field of fuel cell components (bipolar plates and GDLs) since 1996. SGL introduced the first fully-treated GDL roll-to-roll material in 1999. Today SIGRACET ® GDLs are successfully used in various fields ranging from mobility & maritime applications, stationary fuel cells for CHP and UPS, HT-PEMFCs and electrolysers. For BPP manufacturing SGL can offer graphite compounds as well as expanded graphite foils and screen printing technology.

We offer the following:

- BPP made of compound
- BPP made of graphite
- Compounds for making BPP
- screen printing

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

2.2.10 Schunk Kohlenstofftechnik GmbH

Company Name:	Schunk Kohlenstofftechnik GmbH
Adress:	Rodheimer Straße 59 35452 Heuchelheim Germany
Telephone number:	+49 641 608 2308
Email:	bipolarplates@schunk-group.com
Website:	https://www.schunk-carbontechnology.com/en/products/produkte-detail/bipolar-plateshttps://www.schunk-carbontechnology.com/fileadmin/Redakteur/Mediathek/Broschueren/SchunkCarbonTechnology/HighTemperature/Schunk-Bipolarplatten-EN.pdf
Responsible Person:	Jens Völlner

Our graphite bipolar plates for fuel cells are being manufactured especially for the PEMFC and DMFC types. Through many years of development work (start in 1996), we have succeeded in transforming the outstanding material properties of our materials into cost-effective production for high volumes. Our compression molded bipolar plates with integrated flow field are first choice for use in mobile and stationary applications, wherever extreme durability, reliability, high cycle stability and power density are required.

- Use in mobile and stationary applications
- More than 800,000 bipolar plates produced in different applications
- Own compound production and continuous further development of the materials
- Benchmark in the industry and with many research institutes

We offer the following:

- BPP made of compound
- On request

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: up to 600 x 415 mm blank plates (various thicknesses) other dim. on request.

Our minimum order is: On request (dependend on geometry & fabrication technique).

2.2.11 Shanghai Hongfeng Industrial Co., Ltd

Company Name:	Shanghai Hongfeng Industrial Co., Ltd
Adress:	#218 Dongmao Road, Liantang Industrial Park, Qingpu district, Shanghai , China 201716
Telephone number:	86-21-59815535-8880
Email:	zhu.xiaming@shf.net.cn
Website:	http://www.shf.net.cn
Responsible Person:	Tom Zhu

shanghai hongfeng industrial co.,ltdd dedicates for graphite precison manufacturing and development with the wide applications on fuel cell, semiconductor and other fields. It covers an area of 32 acres and 21 thousand square meters building area, SHF has been equipped with the advanced equipments for production and inspection including CNC, CMM, automated vision systems. It was founded in 1996 and since from 2008, SHF have started with fuel cell graphite bipolar plates applied in hydrogen fuel cell. The new R&D centre and manufacturing facility has been put into operation since 2015.

We offer the following:

- BPP made of graphite

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Material Handling
- Portable

We offer seal on BPP.

The maximum we can offer is: 600*400mm.

Our minimum order is: 10plates.

2.3 Other suppliers for BPP

2.3.1 Aalberts Surface Technologies GmbH

Company Name:	Aalberts Surface Technologies GmbH
Adress:	Aalberts Surface Technologies GmbH Seelandstrasse 7 23569 Lübeck
Telephone number:	+49 451 39006-24
Email:	thomas.meurer@aalberts-st.com
Website:	https://www.aalberts-st.com/de/standorte/luebeck/
Responsible Person:	Thomas Meurer

- PVD-coatings on metallic Bipolar Plates (stainless steel, titanium) in Fuel Cells and Electrolyzers
- PVD-coatings on PTL in Electrolyzers
- 3 In-Line coating machines for serial applications
- serial experience of 500.000 pc. bipolar plates in automotive-Fuel Cell stacks and Electrolyzers

We offer the following:

- - PVD-coatings on metallic Bipolar Plates and PTL in Fuel Cells/Electrolyzers

We offer products for the following fuel cell types: LT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maximum we can offer is: 1.700 x 900 mm.

Our minimum order is: 1 pc..

2.3.2 Graebener Maschinentechnik GmbH & Co. KG

Company Name:	Graebener Maschinentechnik GmbH & Co. KG
Adress:	Am Heller 1 57250 Netphen-Werthenbach Germany
Telephone number:	+49 2737 989 0
Email:	info@graebener.com
Website:	www.graebener.com
Responsible Person:	Mr. Fabian Kapp

Graebener® Bipolar Plate Technologies is part of Graebener® Maschinentechnik, a machine building company with locations in Germany, USA and China. For almost 20 years, Graebener® BPT has been one of the first companies to focus on the research and development of hydroforming-based manufacturing processes for bipolar plates.

The company accompanies all strategically important steps towards the optimally designed production plant: Starting from engineering with a view to plate design and plant technology via prototyping and pre-buy service in the in-house application lab up to the customized production plant or line.

Experience from 100 years of metal processing and worldwide customer-specific special solutions are incorporated into the holistic development partnership with the customer.

We offer the following:

- BPP-Engineering, Prototyping & Production, Customized Production Lines & Plants for metallic BPP

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maximum we can offer is: regular approx 500 x 500 mm, other dimension on request.

Our minimum order is: from single piece.

2.3.3 H&T ProduktionsTechnologie GmbH

Company Name:	H&T ProduktionsTechnologie GmbH
Adress:	Gewerbering 26b 08451 Crimmitschau Germany
Telephone number:	+49 (0)170 56 271 91 (Direktkontakt) +49 (0)3762 707 – 100 (Zentrale)
Email:	rico.doerr@ht-pt.com
Website:	https://www.ht-pt.com/
Responsible Person:	Rico Doerr

H&T ProduktionsTechnologie GmbH has over 60 years of experience in developing & manufacturing of metal forming machines & tools as well as of sheet metal forming equipment. We focus on future markets & qualify our technology portfolio further to master these new requirements. In cooperation with regional partners we offer a flexible full-line-concept consiting of forming, washing, joining & stacking process for fuel cell production.

Our company is a member of the Heitkamp & Thumann Group, a group of internationally active medium-sized metal and plastic processing companies. Our product range includes not only a press series completely based on servo technology, but also high-speed mechanical transfer presses, CNC transfer systems, CNC swivel cutting tools & metal bellow machines.

We offer the following:

- We are a supplier of ServoSpindlePresses and Automation technology for manufacturing metallic BPP.

The maximum we can offer is: Max. Size of BPP in agreement with the customer.

Our minimum order is: Production Lines for try out, mid- & large production > 4 Mio BPP/year..

2.3.4 IAG Industrie Automatisierungsgesellschaft m.b.H

Company Name:	IAG Industrie Automatisierungsgesellschaft m.b.H
Adress:	Industriestrasse 2 2722 Weikersdorf Austria
Telephone number:	+43(0)2622 21734-0
Email:	s.gruber@iag.at
Website:	www.iag.at
Responsible Person:	Stefan Gruber (MD)

IAG is a special purpose machinery company in Austria, and market leader for tailor-made special-purpose machinery for the friction lining industry worldwide, fully automatic pressing lines for mass market applications for brake pads, and clutches (where there are similar requirements to graphite compound bipolar plates for PEM Fuel cells). Founded 1996, we have more than 500 machines running globally (all fully automatic)

We are looking for (A) cooperation partners, (B) development partners and / or (C) potential clients to work on fully automatic solutions to (1) achieve mass market needs, (2) get manufacturing costs down to market requirements.

We can provide unique solutions in the field of fully automatic compression moulding lines for mass market applications.

We offer the following:

- we provide fully automatic solutions in the manufacturing process of BPPs for Graphit, Compound BPPs

We offer products for the following fuel cell types: LT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maximum we can offer is: taylor made machines, as per project requirements.

Our minimum order is: single machine order.

2.3.5 Imerys Graphite & Carbon

Company Name:	Imerys Graphite & Carbon
Adress:	via Cantonale 65 6804 Bironico Switzerland
Telephone number:	+41919361242
Email:	raffaele.gilardi@imerys.com
Website:	www.imerys-graphite-and-carbon.com
Responsible Person:	Raffaele Gilardi

Imerys Graphite & Carbon serves a wide range of customers, and we provide solutions for carbon-based applications.

We have a complete portfolio of carbon materials essential for the manufacture of fuel cells:

- ENSACO and C-NERGY conductive carbon blacks provide excellent catalyst support. The high surface area and high purity ensures low corrosion, ideal gas distribution and water management.
- TIMREX graphite powders and aqueous dispersions control hydrophobicity and porosity which allows the manufacture to fine tune the gas and water transport in the gas diffusion and microporous layers of fuel cells.
- TIMREX graphite and ENSACO carbon black powders can provide electrical and thermal conductivity to plastic/resin molded bipolar plates without compromising mechanical stability

We offer the following:

- High purity synthetic graphite and conductive carbon black powders

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

Our minimum order is: 10 kg.

2.3.6 SGL Carbon GmbH

Company Name:	SGL Carbon GmbH
Adress:	Werner von Siemensstrasse 18 86405 MEITINGEN Germany
Telephone number:	+49 8271 3360
Email:	fuelcellcomponents@sglcarbon.com
Website:	www.sglcarbon.com
Responsible Person:	Nico Haak

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We offer the following:

- BPP made of compound
- BPP made of graphite
- Compounds for making BPP
- screen printing

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

2.3.7 Schuler Pressen GmbH

Company Name:	Schuler Pressen GmbH
Adress:	Schuler-Platz 1
	73033 Göppingen
Telephone number:	+497161667949
Email:	hermann.uchtmann@schulergroup.com
Website:	www.schulergroup.com
Responsible Person:	Dr. Hermann Uchtmann

Schuler offers customized first-rate technology in all areas of forming including automation and software solutions, dies, process know-how and service. Schuler's "Bipolar Plate Production Lines" are designed for the upcoming large-scale production of metallic bipolar plates for fuel cell. These systems, based on a servo-driven knuckle-joint press, are adapted to the special requirements of the forming process of bipolar plates and can produce up to 20 million bipolar plates per year. A unique feature is a double-sided material feed, so that with each press stroke the two halves of the bipolar plate - anode and cathode - are produced simultaneously. The anode and cathode can be prejoined by resistance spot welding directly in the press.

We offer the following:

- Forming technology for the large-scale manufacturing of metallic bipolar plates

The maximum we can offer is: 600 x 200 mm^2 Larger solutions available e.g. for electrolyzers.

2.3.8 Schunk Kohlenstofftechnik GmbH

Company Name:	Schunk Kohlenstofftechnik GmbH
Adress:	Rodheimer Straße 59 35452 Heuchelheim Germany
Telephone number:	+49 641 608 2308
Email:	bipolarplates@schunk-group.com
Website:	https://www.schunk-carbontechnology.com/en/products/produkte-detail/bipolar-plateshttps://www.schunk-carbontechnology.com/fileadmin/Redakteur/Mediathek/Broschueren/SchunkCarbonTechnology/HighTemperature/Schunk-Bipolarplatten-EN.pdf
Responsible Person:	Jens Völlner

Our graphite bipolar plates for fuel cells are being manufactured especially for the PEMFC and DMFC types. Through many years of development work (start in 1996), we have succeeded in transforming the outstanding material properties of our materials into cost-effective production for high volumes. Our compression molded bipolar plates with integrated flow field are first choice for use in mobile and stationary applications, wherever extreme durability, reliability, high cycle stability and power density are required.

- Use in mobile and stationary applications
- More than 800,000 bipolar plates produced in different applications
- Own compound production and continuous further development of the materials
- Benchmark in the industry and with many research institutes

We offer the following:

- BPP made of compound
- On request

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer seal on BPP.

The maximum we can offer is: up to 600 x 415 mm blank plates (various thicknesses) other dim. on request.

Our minimum order is: On request (dependend on geometry & fabrication technique).

2.3.9 TRUMPF Laser- und Systemtechnik GmbH

Company Name:	TRUMPF Laser- und Systemtechnik GmbH
Adress:	Johann-Maus-Straße 2 71254 Ditzingen Germany
Telephone number:	+49 7156 303-0
Email:	info@trumpf.com
Website:	www.trumpf.com
Responsible Person:	Dr. Isabel Thome

The high-technology company TRUMPF is the world technological and market leader for machine tools of flexible sheet metal processing, and for industrial lasers.

TRUMPF offers a wide range of different laser solutions for welding, cutting, structuring, decoating, drying and marking.

Especially in the field of metallic bipolarplates the highest requirements for a repeatable welding process apply. By using a laser media-tight and highly precise weld seams can be achieved, which have high mechanical stability at the same time. Thanks to large scan field sizes and highly precise positioning of the bipolar plates, our customers benefit from maximum flexibility and precision.

We offer the following:

- We offer laser and laser-systems for the manufacturing process of mainly metallic but also graphitc bipolarplates: cutting, welding, cleaning, structuring, etc.

2.3.10 thyssenkrupp System Engineering GmbH

Company Name:	thyssenkrupp System Engineering GmbH
Adress:	Richard-Taylor-Str. 89 28777 Bremen Germany
Telephone number:	+49421 6888 41455
Email:	thomas.kuschel@thyssenkrupp.com
Website:	https://www.thyssenkrupp-automation-engineering.com/en/automotive-industry/electric-motor-assembly/fuel-cell
Responsible Person:	Thomas Kuschel, Senior Manager Fuel Cell Assembly & Test

We provide production systems for customized component variance, variable or fixed production quantities. With our assembly and test solutions for fuel cells, it is possible to process more than 10,000,000 cells per year. Our systems for fuel cells are based on both clocked and flow processes. Bipolar plates, both stainless steel and graphite based, and MEAs can be assembled and stacked. The CCM, GDL and Sub-Gasket as components of MEAs can be processed, aligned and assembled as roll material or sheets. Our test benches and in-process test concepts monitor the production quality and ensure the stack performance. The current conditioning times of stacks of up to 12h require extensive technical equipment in the manufacturing process. Together with partners we work on reducing times to 2h.

We offer the following:

- Automated production, sealant application and end-of-line tests with transport solutions for BPPs

Chapter 3

Catalyst suppliers

3.1 Catalyst suppliers

3.1.1 Ames Goldsmith Ceimig

Company Name:	Ames Goldsmith Ceimig
Adress:	Units 1-3 Smeaton Road Wester Gourdie Industrial Estate Dundee, Tayside, UK DD2 4UT
Telephone number:	+44 1382 624 127
Email:	info@ceimig.com
Website:	https://www.ceimig.co.uk/
Responsible Person:	Wayne Thornhill

Ames Goldsmith Ceimig manufacture platinum group metal (PGM) based electrocatalysts which are used in PEM Fuel Cells and Electrolysers. PEM technology uses platinum group metal catalysts to convert water into hydrogen (electrolyser) and hydrogen into water & electricity (fuel cell).

Ames Goldsmith Ceimig is part of Ames Goldsmith Corporation. Ames Goldsmith is a leading manufacturer of chemicals based on precious metals with sites in North America, UK and Asia. Our knowledge of the precious metal markets and the use of PGM chemicals helps our customers in the hydrogen economy which is a key area of focus for the company.

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- Platinum on carbon
- Binary platinum-alloy on carbon
- Iridium containing electrolyser catalsysts

Our minimum order is: 10g.

3.1.2 Heraeus Deutschland GmbH & Co. KG

Company Name:	Heraeus Deutschland GmbH & Co. KG
Adress:	Heraeusstraß 12-14 63450 Hanau Germany
Telephone number:	+49 6181 35-4232
Email:	youn-chong.choi@heraeus.com
Website:	www.herae.us/hydrogen-systems
Responsible Person:	Youn-Chong Choi

Heraeus has been committed to precious metals for more than 160 years, specializing in chemical process catalysts and offering a comprehensive line of homogeneous and heterogeneous catalysts. Utilizing our profound expertise in precious metal catalysts we are providing electrocatalysts for PEM electrolyzers and PEM fuel cells. We develop Pt on Carbon based catalyst systems for various applications equipped with a broad range of different carbon materials including proprietary ones. As precious metals experts we provide all services along the metal loop and invest our resources in the strategic optimization of precious metals usage through material innovations on the one hand and through solutions in Trading as well as Recycling on the other hand.

Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- Platinum on carbon
- Binary platinum-alloy on carbon
- Oxygen evolution reaction catalysts as additive for anode electrodes

3.1.3 TFP Hydrogen Products Ltd

Company Name:	TFP Hydrogen Products Ltd
Adress:	Units 5 & 6 Merchants Quay Pennygillam Industrial Estate Launceston Cornwall PL15 7QA UK
Telephone number:	+44 1566 248 572
Email:	enquiries@TFPhydrogen.com
Website:	https://www.TFPhydrogen.com/
Responsible Person:	Dr. David Hodgson

TFP Hydrogen Products was founded in 2011 as PV3 Technologies and joined the TFP Group in 2021. The company is built on decades of knowledge and expertise in both electrochemical and nano materials, and has a strong focus on sustainability, specialising in the development of materials for the hydrogen economy.

We have an experienced team of electrochemists, developing and manufacturing a range of solutions for applications such as water electrolysers, fuel cells, batteries and medical devices. Our team has many years of experience in electrochemical technology development, enabling an understanding of our customers' specific application requirements and creating a product to meet these. Our goal is to provide cost effective products with high performance and high durability.

We offer products for the following fuel cell types: LT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- Platinum on carbon
- Binary platinum-alloy on carbon
- Ternary platinum-alloy on carbon

3.2 Other suppliers for catalysts

3.2.1 Heraeus Battery Technology GmbH

Company Name:	Heraeus Battery Technology GmbH
Adress:	Heraeusstr. 12 – 14 63450 Hanau Germany
Telephone number:	
Email:	porocarb@heraeus.com
Website:	http://www.heraeus-porocarb.com/
Responsible Person:	Michael Grimm

Heraeus Battery Technology GmbH has developed a porous carbon additive platform called Porocarb®. Our synthetic conductive carbon additives address various energy storage systems, in particular Lithium-Ion Batteries and Fuel Cells. Until now, the design of these systems was limited by the available conductive carbon material options. Imagine a functional carbon material that is designed to exactly fit the application: This is exactly where Porocarb® comes into play. The structural properties of the Porocarb® can be adjusted to the specific application requirements. Properties which can be influenced include electrical and thermal conductivity. Moreover, the carbon skeleton has high mechanical and chemical resistance.

We offer the following types of materials:

- Porocarb® is a synthetic porous carbon additive, which can serve as a catalyst support material and conductive additive.

3.2.2 Imerys Graphite & Carbon

Company Name:	Imerys Graphite & Carbon
Adress:	via Cantonale 65 6804 Bironico Switzerland
Telephone number:	+41919361242
Email:	raffaele.gilardi@imerys.com
Website:	www.imerys-graphite-and-carbon.com
Responsible Person:	Raffaele Gilardi

Imerys Graphite & Carbon serves a wide range of customers, and we provide solutions for carbon-based applications.

We have a complete portfolio of carbon materials essential for the manufacture of fuel cells:

- ENSACO and C-NERGY conductive carbon blacks provide excellent catalyst support. The high surface area and high purity ensures low corrosion, ideal gas distribution and water management.
- TIMREX graphite powders and aqueous dispersions control hydrophobicity and porosity which allows the manufacture to fine tune the gas and water transport in the gas diffusion and microporous layers of fuel cells.
- TIMREX graphite and ENSACO carbon black powders can provide electrical and thermal conductivity to plastic/resin molded bipolar plates without compromising mechanical stability

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- carbon supports for catalyst (carabon black, graphite)

Our minimum order is: 10 kg.

Chapter 4

GDL

4.1 Supplier of carbon fiber paper

4.1.1 SGL Carbon GmbH

Company Name:	SGL Carbon GmbH
Adress:	Werner von Siemensstrasse 18 86405 MEITINGEN Germany
Telephone number:	+49 8271 83 3360
Email:	fuelcellcomponents@sglcarbon.com
Website:	www.sglcarbon.com
Responsible Person:	Nico Haak

SGL CARBON is active in the field of fuel cell components (bipolar plates and GDLs) since 1996. SGL introduced the first fully-treated GDL roll-to-roll material in 1999. Today SIGRACET ® GDLs are successfully used in various fields ranging from mobility & maritime applications, stationary fuel cells for CHP and UPS, HT-PEMFCs and electrolysers.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our materials are available as role. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of GDL:

- Carbon fibre paper
- With MPL

The maxium size we offer is: Roll width 480mm and 710mm.

Our minimum order is: 1500 EUR.

4.1.2 Technical Fibre Products Ltd

Company Name:	Technical Fibre Products Ltd
Adress:	Burneside Mills Kendal Cumbria LA9 6PZ UK
Telephone number:	+44 1539 818 220
Email:	enquiries@tfpglobal.com
Website:	https://www.tfpglobal.com/
Responsible Person:	Adam Black

TFP is a leading global manufacturer of wet-laid wovens and has been developing and optimising material for fuel cell GDLs for three decades, working alongside some of the leading companies in the industry. This has facilitated a comprehensive understanding of the necessary material characteristics to achieve a high performance GDL substrate.

TFP is one of the leading suppliers of GDL substrate globally, offering a range of carbon nonwovens which can be tailored to suit the requirements of both stationary and portable fuel cell systems. To date our materials have been used successfully as GDLs in proton electrolyte membrane (PEMFC), phosphoric acid (PAFC) & direct methanol (DMFC) fuel cells.

TFP's subsidiary TFP Hydrogen Products also offer Pt/C catalysts for fuel cells.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our materials are available as role and sheet. Our products are used in the following applications:

- Automotive
- Portable
- Stationary

We offer the following types of GDL:

- Carbon fibre paper
- Without MPL

The maxium size we offer is: Maximum material width for GDL substrate is 2100mm..

We offer customised sizes.

4.2 Supplier of dry laid paper

4.3 Supplier of cabon cloth

4.4 Other suppliers of GDL

4.4.1 Freudenberg Performance Materials SE & Co. KG

Company Name:	Freudenberg Performance Materials SE & Co. KG
Adress:	Hoehnerweg 2-4 69469 Weinheim Germany
Telephone number:	+49 6201 80 3382
Email:	fuelcell@freudenberg-pm.com / info@freudenberg-pm.de
Website:	www.freudenberg-pm.com
Responsible Person:	Dr. Volker Banhardt

Freudenberg Performance Materials (FPM) is one of the world's leading manufacturers of high-quality performance technical fabrics, nonwovens and textiles. Our solutions are used in many industry s and technical markets. Core competencies include high-performance nonwovens, fibers, spund-bound textiles, composites and technical textiles. These performance textiles, fabrics and nonwovens can be found in automotive, construction, clothing, energy, fuel cells, hygiene, interior design, medical, footwear, leather goods and other specialized applications.

FPM is the industry-leading developer of technical textiles, modern materials, nonwoven solutions and production processes. Together with international customers, Freudenberg manufactures with diverse teams on tailor-made solutions.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our materials are available as role and sheet. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of GDL:

- Without MPL
- With MPL
- with and without hydrophobic treatment, customized MPL coating, lab or production material

The maxium size we offer is: max roll length about 1000lm, max roll width 1000mm.

Our minimum order is: 250 Euro is minimum order volume.

We offer customised sizes.

4.4.2 Imerys Graphite & Carbon

Company Name:	Imerys Graphite & Carbon
Adress:	via Cantonale 65 6804 Bironico Switzerland
Telephone number:	+41919361242
Email:	raffaele.gilardi@imerys.com
Website:	www.imerys-graphite-and-carbon.com
Responsible Person:	Raffaele Gilardi

Imerys Graphite & Carbon serves a wide range of customers, and we provide solutions for carbon-based applications.

We have a complete portfolio of carbon materials essential for the manufacture of fuel cells:

- ENSACO and C-NERGY conductive carbon blacks provide excellent catalyst support. The high surface area and high purity ensures low corrosion, ideal gas distribution and water management.
- TIMREX graphite powders and aqueous dispersions control hydrophobicity and porosity which allows the manufacture to fine tune the gas and water transport in the gas diffusion and microporous layers of fuel cells.
- TIMREX graphite and ENSACO carbon black powders can provide electrical and thermal conductivity to plastic/resin molded bipolar plates without compromising mechanical stability

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of GDL:

- high purity synthetic graphite and carbon black powders, water-based carbon dispersions

Our minimum order is: 10 kg.

Chapter 5

MEA

5.1 MEA supplier

5.1.1 BASF New Business GmbH

Company Name:	BASF New Business GmbH
Adress:	Benckiserplatz 1 67059 Ludwigshafen Germany
Telephone number:	+49 621 60 47866
Email:	carsten.henschel@basf.com
Website:	https://www.basf.com/de/en/company/about-us/companies/BASF_New-Business-GmbH/our-solutions.html
Responsible Person:	Carsten Henschel

BASF New Business commercializes the Celtec products for more than 15 years. BASF has established a knowledge and production network with licensees, toll manufacturers and scientific partners. This MEA operates at temperatures between 120 and 180 °C, tolerating high concentrations of carbon monoxide and being able to run independently of humidification. This technology allows fuel cell systems to be simpler and more cost effective.

Membrane: Polybenzimidazole and phosphoric acid.

7-layer MEA: Membrane, GDE with Pt and Pt/Ni catalysts, internal sealing.

BASF offers cost effective standard MEA designs as well as tailored, customized MEAs.

- Celtec®-P MEA 45 cm^2
- Celtec®-P MEA 165 cm^2
- Celtec®-P MEA 300 cm^2
- Celtec®-P MEA 605 cm^2

We offer products for the following fuel cell types: HT-PEM. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- 7-Layer MEA (CCM + GDL + Subgasket)
- 7-Layer + Sealing

The maxium size we offer is: Active area of 1100 cm^2.

Our minimum order is: 10 MEA.

5.1.2 Blue World Technologies

Company Name:	Blue World Technologies
Adress:	Lavavej 16 9220 Aalborg Øst Denmark
Telephone number:	+45 29 70 74 88
Email:	mfj@blue.world
Website:	https://www.blue.world/
Responsible Person:	Mads Friis Jensen

Blue World Technologies is a leading provider of high-temperature fuel cell technology, components, and systems. With more than 20 years of experience in research, development and system engineering, Blue World Technologies develops and manufactures HT-PEMFC technology and systems for automotive, heavy-duty, and stationary applications.

The primary fuel for Blue World Technologies' FC technology is pure methanol, offering high autonomy, superior energy density, short refueling time and high performance. With extensive focus on system design and thermal integration the FC technology operates with high electrical efficiency ensuring a competitive fuel economy while eliminating all harmful emissions and providing green CO2-neutral power generation.

We offer products for the following fuel cell types: HT-PEM. Our materials are available as sheet. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Stationary

We offer the following types of materials:

- 7-Layer MEA (CCM + GDL + Subgasket)

The maxium size we offer is: 250 mm x 350 mm.

Our minimum order is: Min. volume depends on type (standard or customized).

5.1.3 CMC Klebetechnik GmbH

Company Name:	CMC Klebetechnik GmbH
Adress:	Rudolf-Diesel-Strasse 4 67227 Frankenthal Germany
Telephone number:	+0049 6233 872 356
Email:	friederici@cmc.de
Website:	https://www.cmc.de
Responsible Person:	Gerald Friederici

- CMC Klebetechnik GmbH is a mid-sized German company founded in 1958. CMC is specialised in coatings on engineered and high-performance films like PET, PEN, Kapton®, PEEK, Nomex® or ETFE.
- Coatings can be self-adhesive coatings and other functionalizing coatings from approx. 10μ m to 1000μ m on up to 1.900 mm wide films.
- For the sub gasket of MEA's we offer PEN (PEEK, PPS) films coated with either a heat activated or PSA adhesive coating for sealing and framing the CCM.
- First project was done in 2017 with a major MEA manufacturer in Germany.
- Cooperation in several research projects and automation developments with the ability to modify and develop new coating solutions.
- We do NOT offer complete MEA's but the window-frame film for gasketing the membrane itself before a decal process or the ready coated CCM.
- The materials can be supplied either in rolls in nearly any width, as die-cuts or in sheets. D11

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. Our materials are available as role and sheet.

The maxium size we offer is: max width of coated film 1.700 mm, can be slit down to any size neccessary.

Our minimum order is: approx. 300 m^2, standard »1.000 sqm.

5.1.4 Laufenberg GmbH

Company Name:	Laufenberg GmbH
Adress:	Krüserstraße 2 47839 Krefeld Germany
Telephone number:	+49 2151 74 99 551
Email:	s.kohsakowski@laufenberg.info
Website:	https://laufenberg.info/f-e-produkte/brennstoffzellen-komponenten/
Responsible Person:	Dr. Sebastian Kohsakowski

Laufenberg GmbH is developing and producing "coated fuel cell components" since 2015. We are offering completely developed products as well as our know-how for new projects in the emerging fuel cell sector.

We are specialized in coatings for web-based and flexible carriers, to be offered in roll- or sheet dimensions!

We offer cutomized productions of PEM-fuel cell electrode layers and catalyst coated membranes (CCMs) for industrial usage. The key-benefits of our product are:

1. Adjustable amount of platinum
2. CCM in various thicknesses starting from approx. 30 µ
3. Roll dimension – suitable for serial productions

We offer products for the following fuel cell types: LT-PEM. Our materials are available as role and sheet. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- 3-Layer MEA (CCM)

The maxium size we offer is: Rolls: width up to 550 mm / max weight = 500 kg / max OD = 800 mm.

Our minimum order is: On demand.

5.2 Other suppliers

5.2.1 thyssenkrupp System Engineering GmbH

Company Name:	thyssenkrupp System Engineering GmbH
Adress:	Richard-Taylor-Str. 89 28777 Bremen Germany
Telephone number:	+49421 6888 41455
Email:	thomas.kuschel@thyssenkrupp.com
Website:	https://www.thyssenkrupp-automation-engineering.com/en/automotive-industry/electric-motor-assembly/fuel-cell
Responsible Person:	Thomas Kuschel, Senior Manager Fuel Cell Assembly & Test

We provide production systems for customized component variance, variable or fixed production quantities. With our assembly and test solutions for fuel cells, it is possible to process more than 10,000,000 cells per year. Our systems for fuel cells are based on both clocked and flow processes. Bipolar plates, both stainless steel and graphite based, and MEAs can be assembled and stacked. The CCM, GDL and Sub-Gasket as components of MEAs can be processed, aligned and assembled as roll material or sheets. Our test benches and in-process test concepts monitor the production quality and ensure the stack performance. The current conditioning times of stacks of up to 12h require extensive technical equipment in the manufacturing process. Together with partners we work on reducing times to 2h.

Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

The maxium size we offer is: xxx.

Our minimum order is: xxx.

Chapter 6

Membrane

6.1 Supplier of Nafion membranes

6.2 Supplier of hydrocarbon membranes

6.3 Supplier of PBI membranes

6.3.1 BASF New Business GmbH

Company Name:	BASF New Business GmbH
Adress:	Benckiserplatz 1 67059 Ludwigshafen Germany
Telephone number:	+49 621 60 47866
Email:	carsten.henschel@basf.com
Website:	https://www.basf.com/de/en/company/about-us/companies/BASF_New-Business-GmbH/our-solutions.html
Responsible Person:	Carsten Henschel

BASF New Business commercializes the Celtec products for more than 15 years. BASF has established a knowledge and production network with licensees, toll manufacturers and scientific partners. This MEA operates at temperatures between 120 and 180 °C, tolerating high concentrations of carbon monoxide and being able to run independently of humidification. This technology allows fuel cell systems to be simpler and more cost effective.

The Celtec membrane consists of Polybenzimidazole and phosphoric acid.

The membrane is produced by a sol-gel process.

The customer receives the product with a Certificate of Analysis.

We offer products for the following fuel cell types: HT-PEM. Our materials are available as role and sheet. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Portable
- Stationary

We offer the following types of materials:

- Non-Reinforced
- PBI based

Our minimum membrane thickness is 350. Our maximum membrane thickness is 450.The maxium size we offer is: Roll width 31 cm, length appr. 70 m (appr. 20 m^2).

Our minimum order is: One roll (appr. 20 m^2) - 10 Sheets (DinA4) for testing.

6.3.2 Blue World Technologies

Company Name:	Blue World Technologies
Adress:	Lavavej 16 9220 Aalborg Øst Denmark
Telephone number:	+45 29 70 74 88
Email:	mfj@blue.world
Website:	https://www.blue.world/
Responsible Person:	Mads Friis Jensen

Blue World Technologies is a leading provider of high-temperature fuel cell technology, components, and systems. With more than 20 years of experience in research, development and systems engineering, Blue World Technologies develops and manufactures HT-PEMFC systems for automotive, heavy-duty, and stationary applications.

The primary fuel for Blue World Technologies' FC technology is pure methanol, offering high autonomy, superior energy density, short refueling time and high performance. With extensive focus on system design and thermal integration the FC technology operates with high electrical efficiency ensuring a competitive fuel economy while eliminating all harmful emissions and providing green CO2-neutral power generation.

We offer products for the following fuel cell types: HT-PEM. Our materials are available as role and sheet. Our products are used in the following applications:

- Automotive
- Heavy Duty
- Material Handling
- Stationary

We offer the following types of materials:

- PBI based

Our minimum membrane thickness is 1 um. Our maximum membrane thickness is 100 um.The maxium size we offer is: Width 250 mm, length: 300 m.

Our minimum order is: Min. volume depends on type (standard or customized).

6.4 Other supplier of membranes

Chapter 7

Sealing

7.1 Sealing supplier

7.1.1 AJUSA

Company Name:	AJUSA
Adress:	Parque Empresarial Ajusa. Calle 1 n°1 02006 Albacete Spain
Telephone number:	+34 967 216212
Email:	jmgregorio@ajusa.es
Website:	https://ajusa.es/
Responsible Person:	Jose Manuel Gregorio

AJUSA Hydrogen Technologies focuses its experience since 2003 in the development of fuel cells

type PEM (PEMFC) and its applications for backup systems, mCHP, fuel cell module for automotive and gen sets in general.

Internal development and manufacture of Stacks, bipolar plates and seals.

Hydrogen Refuellin Station of 350 bar, in service since 2012

Several development projects with public grants from the government of Spain

Manufacturing Tech. for Sealing:

-Injection of LSR.

-Vertical / Horizontal Rubber Injection

-Screen-printing.

-Die cutting

Current project: Max Size Seals: 300x450 mm

We offer products for the following fuel cell types: LT-PEM. We offer products made of the following materials:

- Silicon
- FKM
- FFKM
- EPDM
- NBR,

We offer the following types of products:

- Plate
- Ready seal
- Seal on BPP
- Seal on GDL
- Seal on MEA / CCM

We offer customer geometry.

The maxium size we offer is: 300 x 350 mm.

7.1.2 DATRON AG

Company Name:	DATRON AG
Adress:	In den Gänsäckern 5 64367 Mühltal Germany
Telephone number:	+49 6151 14190
Email:	info@datron.de
Website:	http://www.datron.de
Responsible Person:	Dirk Iller

DATRON customers benefit from the combination of our vast experience in the field of CNC machines and highly precise dispensing technology. Due to the dispensing pump being included in the path planning of our axis system, we achieve a very homogeneous material application along the contour path, even within critical start-stop areas.

Focused on fulfilling customer requirements, we offer dispensing cells for manual or semi automated loading, as well as inline systems for fully automated production lines.

Leading German research institutes use DATRON dispensing systems for their challenging projects. We also successfully completed several industrial fc projects, including solutions for industrial leaders who chose DATRON dispensing systems to achieve their goals for the sealing application.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. We offer products made of the following materials:

- Silicon
- All kind of dispensable materials

We offer the following types of products:

- Seal on BPP
- Seal on GDL
- Seal on MEA / CCM

We offer customer geometry.

The maxium size we offer is: We offer machining areas from 300x240mm up to 1500x1000mm.

Our minimum order is: 1.

7.1.3 Eisenhuth GmbH & Co. KG

Company Name:	Eisenhuth GmbH & Co. KG
Adress:	Friedrich-Ebert-Str. 203 37520 Osterode am Herz Germany
Telephone number:	+49 5522 90670
Email:	info@eisenhuth.de
Website:	www.eisenhuth.de
Responsible Person:	Dr. Thorsten Hickmann

Eisenhuth is an innovative companny that skilfully combines tradition with modernity. It has 3 core competences: Mould making, series production for thermoplastice, rubber, silicones and Fuel cell components. Eisenhuth is at the moment one large manufacturer of graphitic bipolar plates and Fuel clel gaskets n Europe. These products are not only distributed in EUrope, but all over the world. Moreover, the company produces Components for Electrolyzers on alkaline and PEM-Basis

The products are suitable for LT PEM, HT PEM and Methanol Fuel cells.

The company has also extended facilities for testing and analysis. ANd some test benches for fuel cells.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. We offer products made of the following materials:

- Silicon
- FKM
- FFKM
- EPDM
- NBR / HNBR / SBR etc.

We offer the following types of products:

- Plate
- Ready seal
- Seal on BPP
- Seal on GDL
- Seal on MEA / CCM

We offer costumer geometry.

The maxium size we offer is: 500 x500.

Our minimum order is: 1.

7.1.4 Freudenberg FST GmbH

Company Name:	Freudenberg FST GmbH
Adress:	Hoehnerweg 2-4 69469 Weinheim Germany
Telephone number:	+49 (0) 6201 80-66 66
Email:	info@fst.com
Website:	www.fst.com
Responsible Person:	Jürgen Emig - Division Gaskets

The Freudenberg Group is already since early 2000 active in the segment Fuel Cells and this with a wide range of products. This starts with GDLs, filters, humidifier and of course various sealing solutions.

With regards to sealing solutions is Freudenberg FST offering material, design and manufacturing competence combined with a global footprint.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. We offer products made of the following materials:

- Silicon
- FKM
- FFKM
- EPDM
- FCPO (Fuel Cell Polyolefin)

We offer the following types of products:

- Ready seal
- Seal on BPP
- Seal on GDL
- Seal on MEA / CCM

We offer costumer geometry.

The maxium size we offer is: to be defined and agreed on customer requirements and business potential.

Our minimum order is: subject of product type (standard or customized).

7.1.5 GETELEC

Company Name:	GETELEC
Adress:	375 avenue Morane Saulnier 78535 Buc France
	Office Germany: Ellwangen (Jagst)
Telephone number:	+497961/5799824
Email:	info@getelec.com
Website:	https://www.getelec.com/en/
Responsible Person:	Maria Gloning

For more than 50 years, GETELEC has been designing and manufacturing bespoke technical sealing solutions. GETELEC products are suitable for the protection of high-tech equipment. We have become a world specialist in elastomer formulations and a key partner of major customers in many industries. Our materials are developed by our chemical engineers. From the selection of raw materials to final processing, we make specific formulations for each application. This mastery allows us to offer you a bespoke solution adapted to your needs and your specifications.

For the usage in fuel cells we developed a special seal. Their objective is to control the compression that ensures the sealing of the cell and the reliability of the contact between the different materials composing the core of the cell.

We offer products for the following fuel cell types: LT-PEM. We offer products made of the following materials:

- Silicon
- FKM
- FFKM
- EPDM
- NBR, Chloropren-Kautschuk

We offer the following types of products:

- Ready seal
- Seal on BPP
- Seal on GDL
- Seal on MEA / CCM

We offer costumer geometry.

The maxium size we offer is: Depends on customer requirements and the material composition.

Our minimum order is: 300€ /order.

7.1.6 Laufenberg GmbH

Company Name:	Laufenberg GmbH
Adress:	Krüserstraße 2 47839 Krefeld Germany
Telephone number:	+49 2151 74 99 551
Email:	s.kohsakowski@laufenberg.info
Website:	https://laufenberg.info/f-e-produkte/brennstoffzellen-komponenten/
Responsible Person:	Dr. Sebastian Kohsakowski

Laufenberg GmbH is developing and producing "coated fuel cell components" since 2015. We are offering completely developed products as well as our know-how for new projects in the emerging fuel cell sector.

We are specialized in coatings for web-based and flexible carriers, to be offered in roll- or sheet dimensions!

Our silicone-flat sealing for PEM-fuel cells were especially developed with industrial partners and research institutes, in order to offer affordable high quality sealings. The key-benefits of our sealing are:

1. High density and improved stability
2. Optimal positioning and handling
3. Very low surface roughness an even surface profile with high adhesion

We offer products for the following fuel cell types: LT-PEM. We offer products made of the following materials:

- Silicon
- Polyester

We offer the following types of products:

- Plate
- Ready seal

We offer customer geometry.

The maxium size we offer is: Rolls: width up to 550 mm / max weight = 500 kg / max OD = 800 mm.

Our minimum order is: On demand.

7.1.7 RAMPF Polymer Solutions GmbH & Co. KG

Company Name:	RAMPF Polymer Solutions GmbH & Co. KG
Adress:	Robert-Bosch-Str. 8-10 72661 Grafenberg Germany
Telephone number:	+49 7123 9342 1718
Email:	sebastian.kaercher@rampf-group.com
Website:	www.rampf-group.com
Responsible Person:	Sebastian Kärcher

RAMPF Polymer Solutions is a leading developer and manufacturer of reactive resin systems based on polyurethane, epoxy, and silicone. The product portfolio includes liquid and thixotropic sealing systems, electro and engineering casting resins, edge and filter casting resins, adhesive systems, and hotmelt adhesives.

We offer products for the following fuel cell types: LT-PEM and DMFC. We offer products made of the following materials:

- Silicon

We offer the following types of products:

- Raw material, e.g. for dispensing

We offer costumer geometry.

The maxium size we offer is: Available in different viscosities for different gasket dimensions. .

Our minimum order is: 500 kg per Component (2C-System).

7.2 Other suppliers for sealings

7.2.1 Illuming Power Inc.

Company Name:	Illuming Power Inc.
Adress:	1030 East Cordova St Vancouver, BC Canada V6A 4A3
Telephone number:	+1-604-210-4382
Email:	mike.joyce@illumingpower.com
Website:	www.illumingpower.com
Responsible Person:	Mike Joyce

Illuming Power develops hydrogen fuel cell technologies, specializing in stack, component and materials design, prototyping, and testing development. We develop technologies that provide a step change improvement in performance and manufactured cost reduction for our clients in the hydrogen fuel cell industry.

We specialize in stack, plate, seal and MEA design; BPP bonding, sealing and test process design; using our expertise in FC fluid, materials and electrochemical design, test and modeling. Our in-house prototype manufacturing, test stations and materials science lab facilitate fundamental materials testing, plate and stack leak testing, and performance testing of single cells (sub-scale and full scale).

We offer products for the following fuel cell types: LT-PEM. We offer products made of the following materials:

-

We offer the following types of products:

- Ready seal
- Seal on MEA / CCM

We offer customer geometry.

7.2.2 Poloyprocess GmbH

Company Name:	Poloyprocess GmbH
Adress:	Am Wald 15 D-97348 Roedelsee Germany
Telephone number:	+49 9323 87590
Email:	info@polyprocess.de
Website:	www.polyprocess.de
Responsible Person:	Hermann Block

Polyprocess GmbH, founded in 1993, is a specialist in applications of liqid polymer formulations for potting and sealing of technical components. Main business is the application of Formed In Place Gaskets (FIPGs), e. g. for housings and covers. Potting appliacions are offered for electrical components like connectors, plugs and circuits. Since 2011 the company developes compounds and sealing processes for FC components. In 2016 a patent was granted for a sealing application in HT-PEM cells based on fuoroelastomers (EPA 2 858 139). Recent developments are related to highly conductive glued joints of carbon based battery components in harsh environments.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. We offer products made of the following materials:

- Silicon
- FKM
- PVDF

We offer the following types of products:

- Seal on BPP
- Seal on GDL

We offer customer geometry.

The maxium size we offer is: 1000 mm x 1500 mm.

Our minimum order is: Sampling and small size orders are charged by a sampling fee..

7.2.3 RAMPF Production Systems GmbH & Co. KG

Company Name:	RAMPF Production Systems GmbH & Co. KG
Adress:	Römerallee 14 78658 Zimmern o.R. Germany
Telephone number:	+49 741 2902 0
Email:	alexander.huttenlocher@rampf-group.com
Website:	www.rampf-group.com
Responsible Person:	Alexander Huttenlocher

RAMPF Production Systems is a leading manufacturer of dosing and mixing machines for reactive resins based on polyurethane, epoxy and silicone.

In the field of Fuel Cell production we offer automated systems to apply sealings and/or adhesives on GDL including quality control, testing, assembling due to customer requirements.

Testing in our lab is offered in an early stage for sample production up to smaller series.

We offer products for the following fuel cell types: LT-PEM, HT-PEM and DMFC. We offer products made of the following materials:

- Mixing- and dosing equipment to apply the sealing material

We offer costumer geometry.

The maxium size we offer is: no limitation.

Our minimum order is: 1.

Chapter 8

Appendix

8.1 BPP business

Supplier	Application					Usage			Material				
	Automotive	*Heavy Duty*	*Material Handling*	*Portable*	*Stationary*	*LT-PEM*	*HT-PEM*	*DMFC*	*Metallic BPP*	*BPP made of compound*	*BPP made of graphite*	*Compounds for making BPP*	*Others*
2.2.1 AJUSA	X	X	X	X	X	X	-	-	X	X	-	-	-
2.3.1 Aalberts Surface Technologies GmbH	X	X	X	X	X	X	-	X	-	-	-	-	X
2.2.2 Blue World Technologies	X	X	X	-	X	-	X	-	-	X	-	-	-
2.1.2 Borit NV	X	X	X	X	X	X	X	X	X	-	-	-	-
2.2.3 Centroplast Engineering Plastics GmbH	-	X	X	X	X	X	X	X	-	X	-	X	-
2.1.3 Dana Incorporated - REINZ-Dichtungs-GmbH	X	X	X	X	X	X	-	-	X	-	-	-	-
2.2.4 Eisenhuth GmbH & Co. KG	X	X	X	X	X	X	X	X	-	X	X	X	-
2.2.5 Ensinger GmbH	X	X	X	X	X	X	X	X	-	-	-	X	-
2.2.6 Entegris GMBH	X	X	X	X	X	X	X	X	-	-	X	-	-
2.3.2 Graebener Maschinentechnik GmbH & Co. KG	X	X	X	X	X	X	X	X	X	-	-	-	X
2.3.3 H&T ProduktionsTechnologie GmbH	-	-	-	-	-	-	-	-	-	-	-	-	X
2.3.4 IAG Industrie Automatisierungsgesellschaft m.b.H	X	X	X	X	X	X	-	-	-	X	X	X	X
2.2.7 Illuming Power Inc	X	X	X	-	-	X	-	-	-	-	X	-	-
2.3.5 Imerys Graphite & Carbon	X	X	X	X	X	X	X	X	-	-	-	-	X
2.2.8 NeoGraf Solutions, LLC	X	X	X	X	X	X	X	-	-	-	X	-	-
2.3.6 SGL Carbon GmbH	X	X	X	X	X	X	X	X	-	X	X	X	X
2.1.4 SITEC Industrietechnologie GmbH	X	X	X	X	X	X	X	X	X	-	-	-	-
2.3.7 Schuler Pressen GmbH	-	-	-	-	-	-	-	-	-	-	-	-	X
2.3.8 Schunk Kohlenstofftechnik GmbH	X	X	X	X	X	X	X	X	-	X	-	-	X
2.2.11 Shanghai Hongfeng Industrial Co., Ltd	X	-	X	X	-	X	X	X	-	-	X	-	-
2.3.9 TRUMPF Laser- und Systemtechnik GmbH	-	-	-	-	-	-	-	-	-	-	-	-	X
2.3.10 thyssenkrupp System Engineering GmbH	-	-	-	-	-	-	-	-	-	-	-	-	X
2.1.5 Weil Technology GmbH	X	-	X	X	X	X	X	-	X	-	-	-	-

8.2 Catalyst business

Supplier	Application					Usage			Material				
	Automotive	*Heavy Duty*	*Material Handling*	*Portable*	*Stationary*	*LT-PEM*	*HT-PEM*	*DMFC*	*Platinum on carbon*	*Binary platinum-alloy on carbon*	*Ternary platinum-alloy on carbon*	*Non-precious metal catalyst*	*Others*
3.1.1 Ames Goldsmith Ceimig	X	X	X	X	X	X	-	-	X	X	-	-	X
3.2.1 Heraeus Battery Technology GmbH	-	-	-	-	-	-	-	-	-	-	-	-	X
3.1.2 Heraeus Deutschland GmbH & Co. KG	X	X	X	X	X	-	-	-	X	X	-	-	X
3.2.2 Imerys Graphite & Carbon	X	X	X	X	X	X	X	X	-	-	-	-	X
3.1.3 TFP Hydrogen Products Ltd	X	X	X	X	X	X	-	-	X	X	X	-	-

8.3 GDL business

Supplier	Application					Usage			Material					
	Automotive	*Heavy Duty*	*Material Handling*	*Portable*	*Stationary*	*LT-PEM*	*HT-PEM*	*DMFC*	*Carbon fibre paper*	*Dry laid paper*	*Carbon cloth*	*Without MPL*	*With MPL*	*Others*
4.4.1 Freudenberg Performance Materials SE & Co. KG	X	X	X	X	X	X	X	X	-	-	-	X	X	X
4.4.2 Imerys Graphite & Carbon	X	X	X	X	X	X	X	X	-	-	-	-	-	X
4.1.1 SGL Carbon GmbH	X	X	X	X	X	X	X	X	X	-	-	-	X	-
4.1.2 Technical Fibre Products Ltd	X	-	-	X	X	X	X	X	X	-	-	X	-	-

8.4 Mea business

Supplier	Application					Usage			Material			
	Automotive	*Heavy Duty*	*Material Handling*	*Portable*	*Stationary*	*LT-PEM*	*HT-PEM*	*DMFC*	*3-Layer MEA (CCM)*	*5-Layer MEA (CCM + GDL/MPL)*	*7-Layer MEA (CCM + GDL + Subgasket)*	*7-Layer + Sealing*
5.1.1 BASF New Business GmbH	X	X	X	X	X	-	X	-	-	-	X	X
5.1.2 Blue World Technologies	X	X	X	-	X	-	X	-	-	-	X	-
5.1.3 CMC Klebetechnik GmbH	-	-	-	-	-	X	X	X	-	-	-	-
5.1.4 Laufenberg GmbH	X	X	X	X	X	X	-	-	X	-	-	-
5.2.1 thyssenkrupp System Engineering GmbH	X	X	X	X	X	-	-	-	-	-	-	-

8.5 Membrane business

Supplier	Application					Usage			Material						
	Automotive	*Heavy Duty*	*Material Handling*	*Portable*	*Stationary*	*LT-PEM*	*HT-PEM*	*DMFC*	*Reinforced*	*Non-Reinforced*	*Chemically stablizied*	*Nafion based*	*Hydrocarbon*	*PBI based*	*Others*
6.3.1 BASF New Business GmbH	X	X	X	X	X	-	X	-	-	X	-	-	-	X	-
6.3.2 Blue World Technologies	X	X	X	-	X	-	X	-	-	-	-	-	-	X	-

8.6 Sealing business

Supplier	Usage			Material				
	LT-PEM	*HT-PEM*	*DMFC*	*Silicon*	*FKM*	*FFKM*	*EPDM*	*Other*
7.1.1 AJUSA	X	-	-	X	X	X	X	X
7.1.2 DATRON AG	X	X	X	X	-	-	-	X
7.1.3 Eisenhuth GmbH & Co. KG	X	X	X	X	X	X	X	X
7.1.4 Freudenberg FST GmbH	X	X	X	X	X	X	X	X
7.1.5 GETELEC	X	-	-	X	X	X	X	X
7.2.1 Illuming Power Inc.	X	-	-	-	-	-	-	X
7.1.6 Laufenberg GmbH	X	-	-	X	-	-	-	X
7.2.2 Poloyprocess GmbH	X	X	X	X	X	-	-	X
7.1.7 RAMPF Polymer Solutions GmbH & Co. KG	X	-	X	X	-	-	-	-
7.2.3 RAMPF Production Systems GmbH & Co. KG	X	X	X	-	-	-	-	X