Production and recycling of composites with the focus on carbon

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Autefa Solutions Group

- 5 locations (D, I, A, USA, CHN)
- headquarter: Friedberg, D
- Main shareholder: China Hi Tech Group
- Sales volume: > 60 Mio. EUR/a
- employees: 290
AUTEFA Solutions Market Activities

AUTEFA Solutions Italy

AUTEFA Solutions Germany

AUTEFA Solutions Austria

AUTEFA Solutions Wuxi

Automation  Baling  Nonwoven  Wool
AUTEFA Solutions **Italy** Technologies

- **F.O.R.** Nonwoven Preparation and Carding machines
- **FEHRER** Aerodynamic Web Forming Machinery
- **OCTIR** Wollen and Worsted Cards
AUTEFA Solutions *Germany* GmbH

- AUTEFA Baling Systems
- AUTEFA Automation Systems
- AUTEFA Nonwoven
AUTEFA Solutions Austria GmbH

- Needle punching machines
- Papermaker felt
  Needle punching machines
Adapted machines made by AS Wuxi
Composite activities:

- Precursor production
- Yarn/roving production
- Recycling to Nonwoven products
Autefa Solutions Group

Composite activities:

• Precursor production
  • Yarn/roving production
  • Recycling to Nonwoven products
Tow plaiting and logistic systems

Specific advantages of AUTEFA

- over 50 years of experience in projects
- 35 tow balers with 150 tow plaiters in operation worldwide
- uniform tow distribution by precise plaiting pattern (PROFILING)
- high capacities and package sizes
- high standard of engineering and manufacturing
Tow plaiting and logistic systems

Modular system

- tow conveying and guiding
- plaiter with tramper
- Container / package
- Package transport
Tow plaiter

- Precise guiding
- 3 roller guidance
- Adaptive filling pressure
- Intelligent tow placement profiles to ensure uniform filling
- Tramper devices for even tow profile in the box
Plaiting & Tramping
Tow plaiting installation
Box filling
Container filling and baling
Composite activities:

- Precursor production
- Yarn/roving production
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Carbon and glass yarn / roving production

Automation in package handling:

- Risk of damage in manual handling carbon rovings
- higher package weights
- Protection on transport needed
- Applicable in
  - Roving production
  - Further processing

- Integrated automation based on modular components
Doffing & Tube Handling
Package Transport
Bobbin Inspection
Storage systems
Film Bagging
Advanced Packing Systems
Palletizing
Storage Systems
Automation concept: carbon roving production

- Winder
- Doffer
- Buffer area
- Packing/Palletizing
- Handling robot
Automation concept: carbon roving production
Automation concept: carbon processing

Packing robot
Package supply
Slip sheets
Empty tubes
Creel
Control cabinet
Composite activities:

• Precursor production

• Yarn/roving production

• Recycling to Nonwoven products
Carbon recycling

- Composite manufacturing leaves up to 35% waste

- Recycling is mandatory
  - Increase of raw material utilization
  - No deposit allowed

- Nonwoven is the easiest way of fabric production

- Web based composites show potential for a lot of applications
Carbon Recycling Concept

WASTE PREPARATION OF DRY AND HARDENED COMPOSITE WASTE

FIBER SEPARATION AND FIBER OPENING
Tearing machine

FIBER BLENDING

COMPOSITE MANUFACTURING

WEB FORMATION
Carding
LayerMaster C
Aerodynamic Webforming Machine
Airlay Card K12-direct
Mat Forming
Chute Feeder CF

WINDING – STACKING

WEB BONDING
Needle Process
Thermobonding Process
Carbon Recycling Concept

- WASTE PREPARATION OF DRY AND HARDENED COMPOSITE WASTE
- COMPOSITE MANUFACTURING
- WINDING – STACKING
- FIBER SEPARATION AND FIBER OPENING
  - Tearing machine
- FIBER BLENDING
- WEB FORMATION
  - Carding
    - LayerMaster C
  - Aerodynamic Webforming Machine
    - Airlay Card K12-direct
  - Mat Forming
    - Chute Feeder CF
- WEB BONDING
  - Needle Process
  - Thermobonding Process
Waste recycling: preparation steps

- **Dry waste**
  - Sorting
  - Cutting (length/crosswise)
  - Base for further fiber opening

- **Hardened composite waste**
  - Thermical or chemical elimination of resin
  - Direct feeding to opening and blending devices
Carbon Recycling Concept

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Fiber separation and opening

Tearing machine
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Mat Forming
Chute Feeder CF
Fiber blending

AUTOMATIC BLENDING BOX
Carbon Recycling Concept

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- WINDING – STACKING
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Web formation concept

• **Carding**
  • Light weights
  • High fiber orientation
  • High fiber separation

• **Airlay**
  • Medium weights
  • Medium fiber orientation
  • Medium opening

• **Mat forming**
  • Higher weights
  • Low fiber orientation
  • Low opening
Web forming principles

Weight Ranges

Carding
Airlay
Mat forming

Ranges
High Performance Card
Airlay K 12 DIRECT

Airlay installation: CF - K12 DIRECT
Airlay K 12 DIRECT
Typical Airlay products
K 12 DIRECT

50% Glas / 50% PP
1200g/m², 360kg/h/m

INPUT

OUTPUT
Carbon Recycling Concept

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Web bonding

- **Mechanical bonding**
  - Needling allows soft bonding
  - No additional material necessary
  - Increases density in the web
  - Low energy consumption

- **Thermical bonding**
  - Additional low melt fiber necessary (PP)
  - Keeps density in the web
  - Higher energy consumption
Mechanical bonding: needle loom
Thermical bonding

Airlay line

Airlay – needling - thermobonding
Carbon Recycling Concept

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WINDING – STACKING
Composite manufacturing

- Recycling will allow better economics in composite manufacturing
- Nonwoven products may also find applications in composites independent from recycling, as
  - Nonwoven is the most economic way of fabric formation
  - Nonwoven fabrics have a very good uniformity in „micro scale“
  - Nonwoven fabrics show good potential for applications in lightweight designs
Our technologies for your success

Thank you for your attention!