How to industrialize CFRPs? – Challenges and opportunities

11th International Carbon Festival
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David Weinberg, Voith Composites GmbH & Co. KG
Agenda

- Voith Composites
- CFRPs: Challenges and opportunities
- Summary
### Voith Group Facts and figures

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>In over</td>
<td>50</td>
<td>20,000</td>
<td>5</td>
</tr>
<tr>
<td>countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees</td>
<td></td>
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<tr>
<td>Markets</td>
<td></td>
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<tr>
<td>R&amp;D ratio</td>
<td>4.9%</td>
<td></td>
<td></td>
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<tr>
<td>Family-owned since</td>
<td>1867</td>
<td></td>
<td></td>
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<tr>
<td>Sales</td>
<td>4.4 BEUR</td>
<td></td>
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Stand: 2014/15
Voith Group
Core markets

- Transport & Automotive
  Sales share: 32%

- Paper
  Sales share: 28%

- Energy
  Sales share: 27%

- Oil & Gas
  Sales share: 5%

- Raw Materials
  Sales share: 2%

Important partnerships:
SGL Carbon AG
KUKA AG

Note: Base: Fiscal year 14/15; others account for 6% of revenue
How to industrialize CFRPs? | D. Weinberg | 2016-10-05 | Public
Voith Composites within the Voith Group

Voith Composites is centrally organized and reports – as an innovation unit for this material – directly to the Board of Management.
CFRPs: Challenges and opportunities
## What are the costs of lightweight construction?

<table>
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<tr>
<th>Acceptable additional costs¹</th>
<th>Production costs² &amp; lightweight potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acc. add. costs (EUR/kg)</strong></td>
<td><strong>Volume p.a.</strong></td>
</tr>
<tr>
<td>Space</td>
<td>10,000</td>
</tr>
<tr>
<td>Wide-body aircraft</td>
<td>1,000</td>
</tr>
<tr>
<td>Automotive</td>
<td>5-15</td>
</tr>
</tbody>
</table>

Note: All numbers are average ranges that are dependent on a variety of factors such as the exact composition and component type.

¹ Accepted additional costs for reducing the weight by 1kg.² Processed structural component.
Composite production Challenges

Today’s challenges

• Engineered as “Black Metal”
• High carbon fiber prices
• Production processes with long cycle times
• Multiple and manual process steps

→ Low quantities of 1-1,000 pieces p.a.

Current challenges result in the avoidance of CFRPs in series with large scale volumes
Composite production
Challenges

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Influenceable by CFRP producers
Composites production
Industrialization

Today ...
Various manual activities

... tomorrow
Highly automated production

Combine and leverage Voith competences
Leaner process chain through elimination of process steps\(^1\)

Cost reduction through eliminating and optimizing process steps

\(^1\) Process chain for large-area and complex components with thermoset or thermoplastic polymers
Voith Solutions
Preforming

Overview: Voith direct fiber placement solutions

Direct fiber placement

Target:
From the fiber directly
to the preform

Voith Long-fiber
Preformer (VLP)

Voith Roving
Applicator (VRA)

Voith Prepreg
Winding (VPW)
Voith Solutions
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Voith Prepreg Winding (VPW)
Voith Roving Applicator (VRA)
Serial process

- Highly interlinked and automated automotive mass production of CFRPs (>50,000 units/years)
- Preform production through direct fiber placement technology
- Current cycle time: <5 min (1.5 min possible)
- Usage of 50k rovings
- Current injection process: HP-RTM Technology (3 component system)
  ➔ Future trend: wet pressing
- Milling process
- After cleaning process, assembly through bonding and riveting (even for safety critical components)
- Manufacturing of a hybrid structural component
Summary

- Today, CFRPs as lightweight material are too expensive for the majority of applications.
- The combination of the different positive characteristics of CFRPs results in niche applications.
- The industrialization of CFRP production together with the integration of process steps is the key for cheaper manufacturing costs.
- Fiber suitable design in close co-operation with the vehicle manufacturers and cheaper carbon fiber prices are a prerequisite to establish CFRPs in the automotive material mix.
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