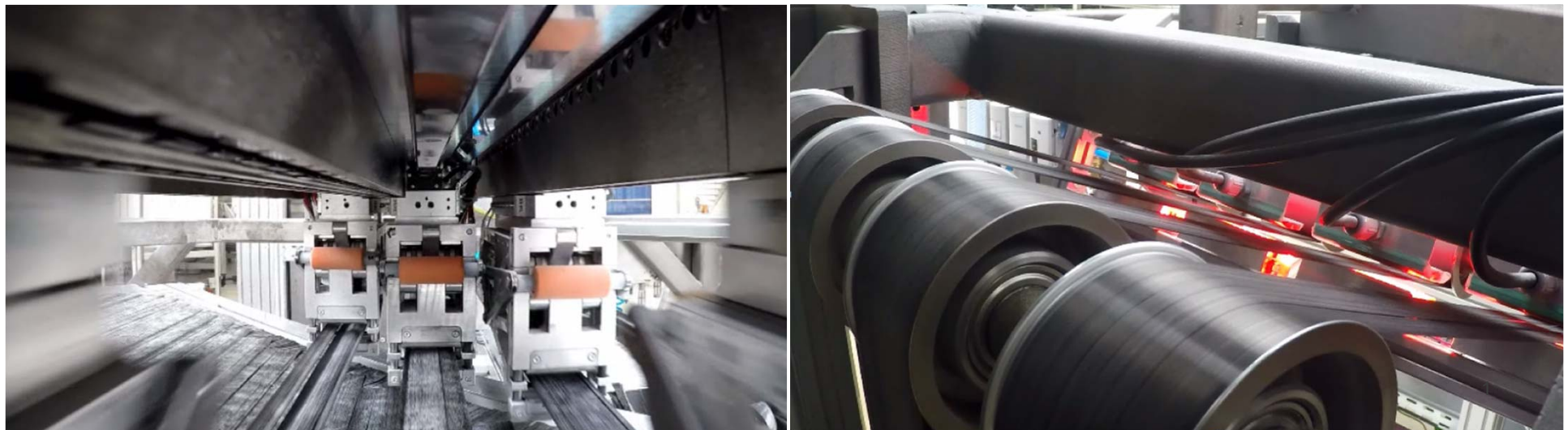


How to industrialize CFRPs? – Challenges and opportunities

11th International Carbon Festival

October 05-07, 2016

David Weinberg, Voith Composites GmbH & Co. KG



Agenda

- Voith Composites
- CFRPs: Challenges and opportunities
- Summary

Voith Composites

Voith Group Facts and figures

In over **50** countries | **20,000** Employees | **5** Markets

R&D ratio

4.9 %

Family-owned since

1867

Sales

4.4 BEUR

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%

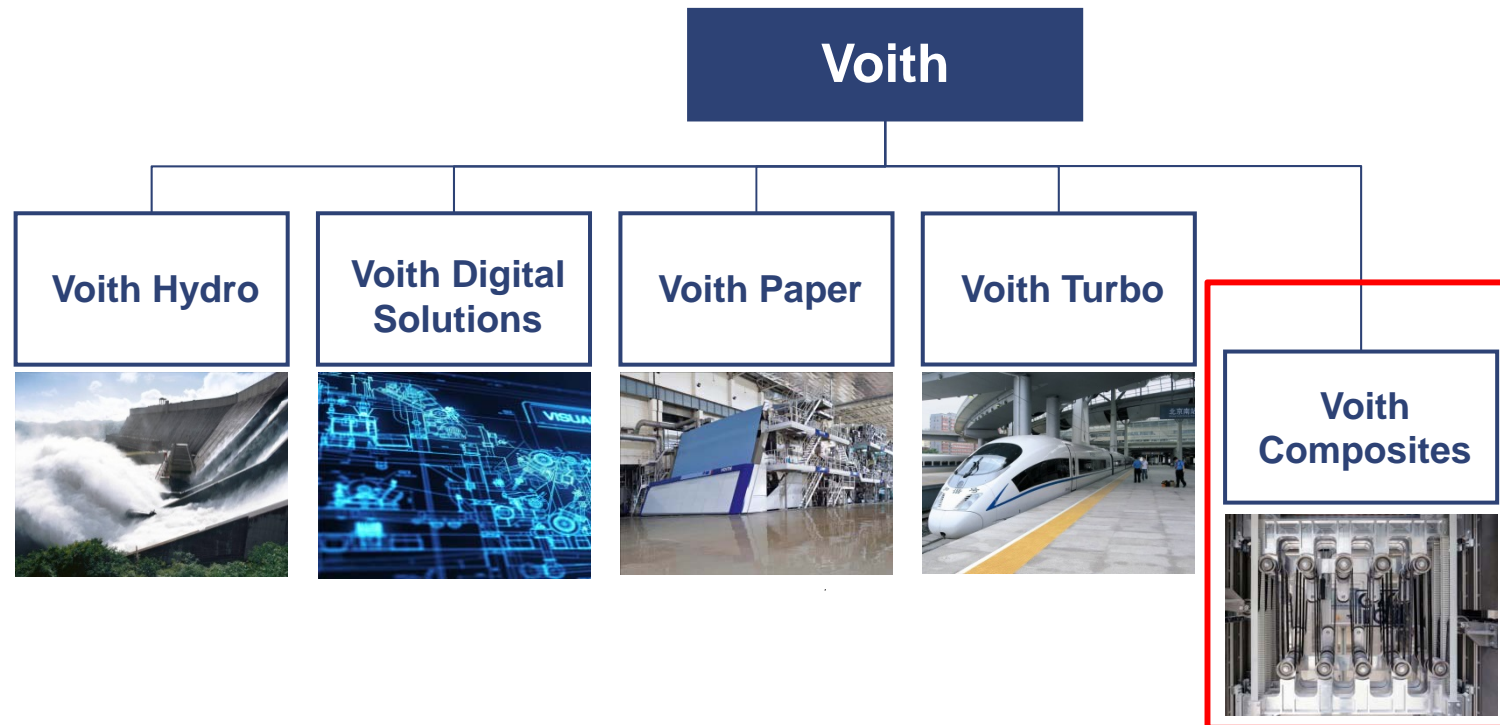


Important partnerships:

SGL Carbon AG

KUKA AG

Voith Composites within the Voith Group



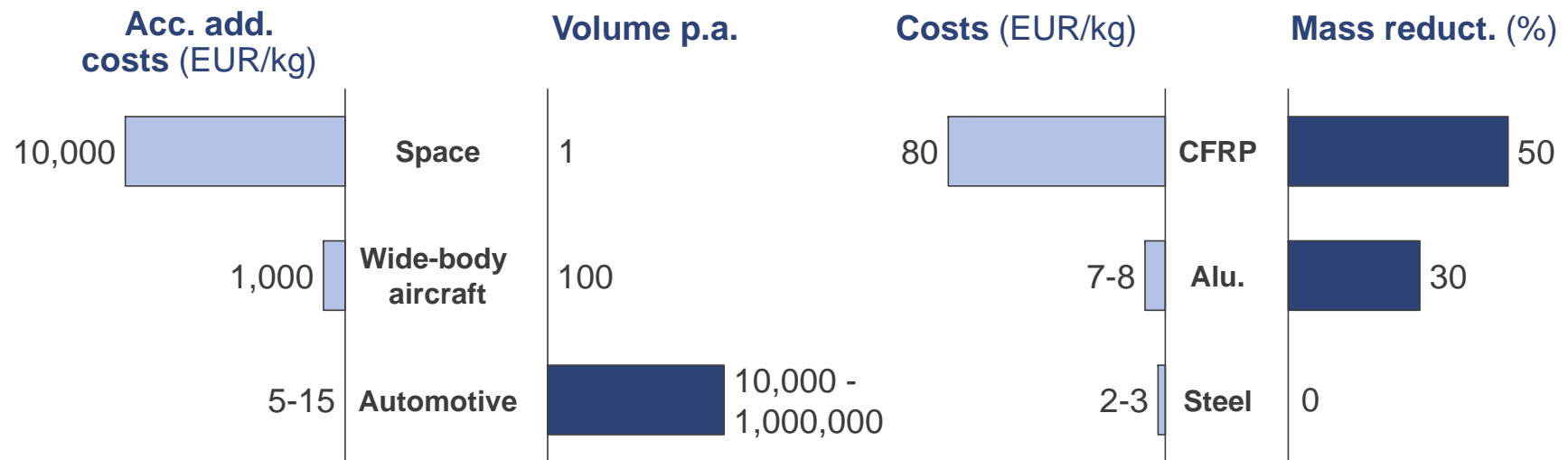
Voith Composites is centrally organized and reports – as an innovation unit for this material – directly to the Board of Management

CFRPs: Challenges and opportunities

What are the costs of lightweight construction?

Acceptable additional costs¹

Production costs² & lightweight potential



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

How to industrialize CFRPs? | D. Weinberg | 2016-10-05 | Public

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

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

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

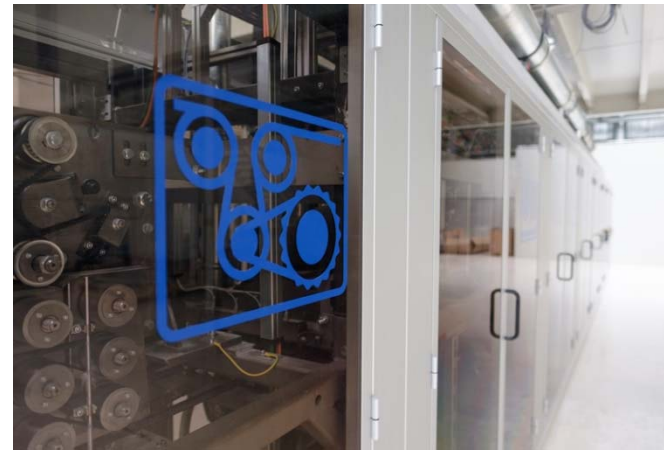
Composites production Industrialization

Today ...

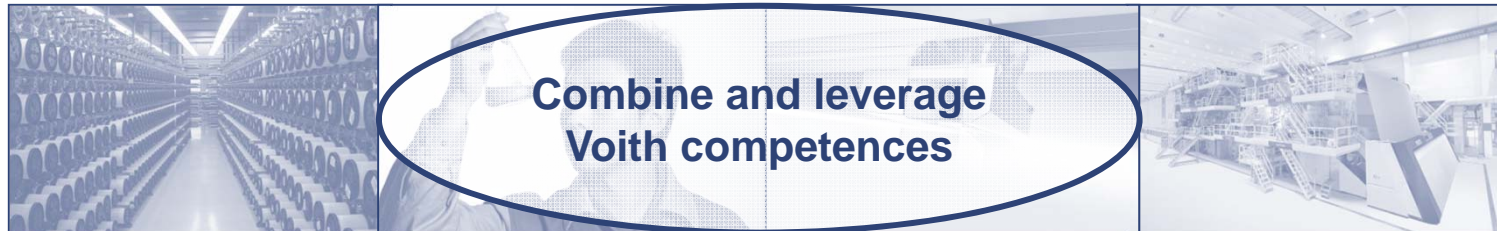


Various manual activities

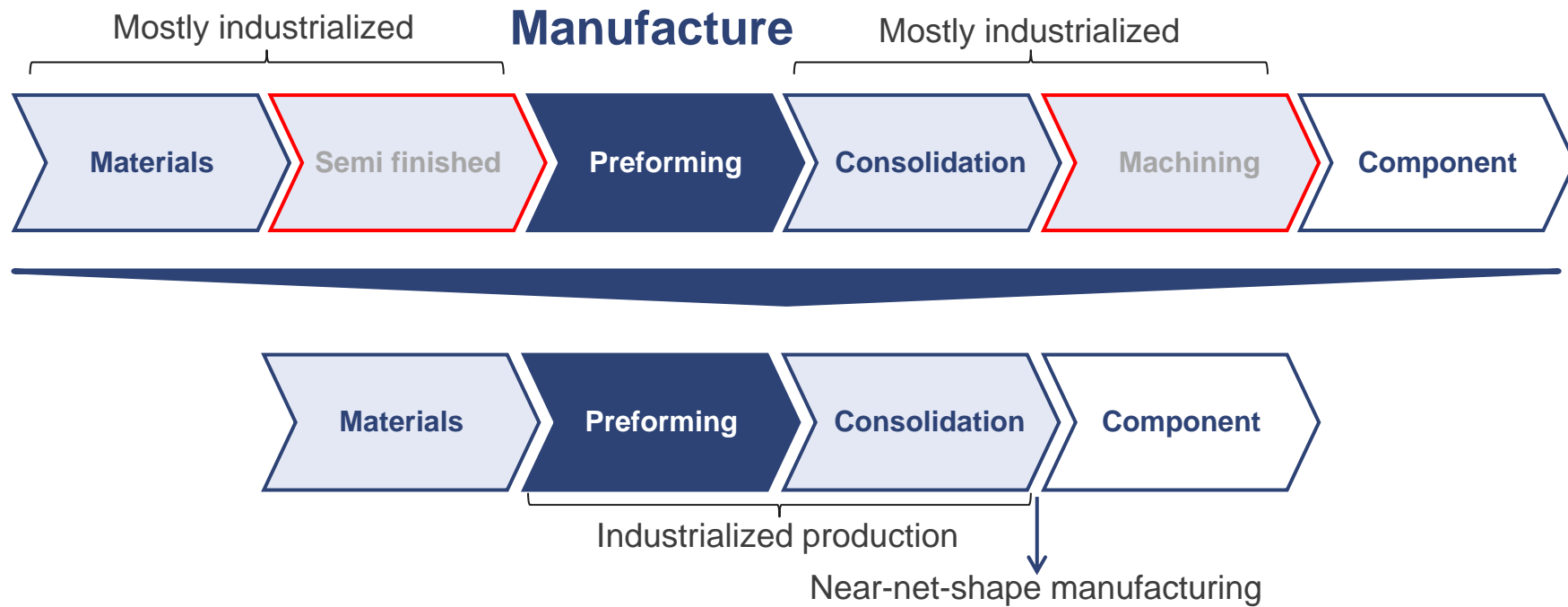
... tomorrow



Highly automated production



Leaner process chain through elimination of process steps¹

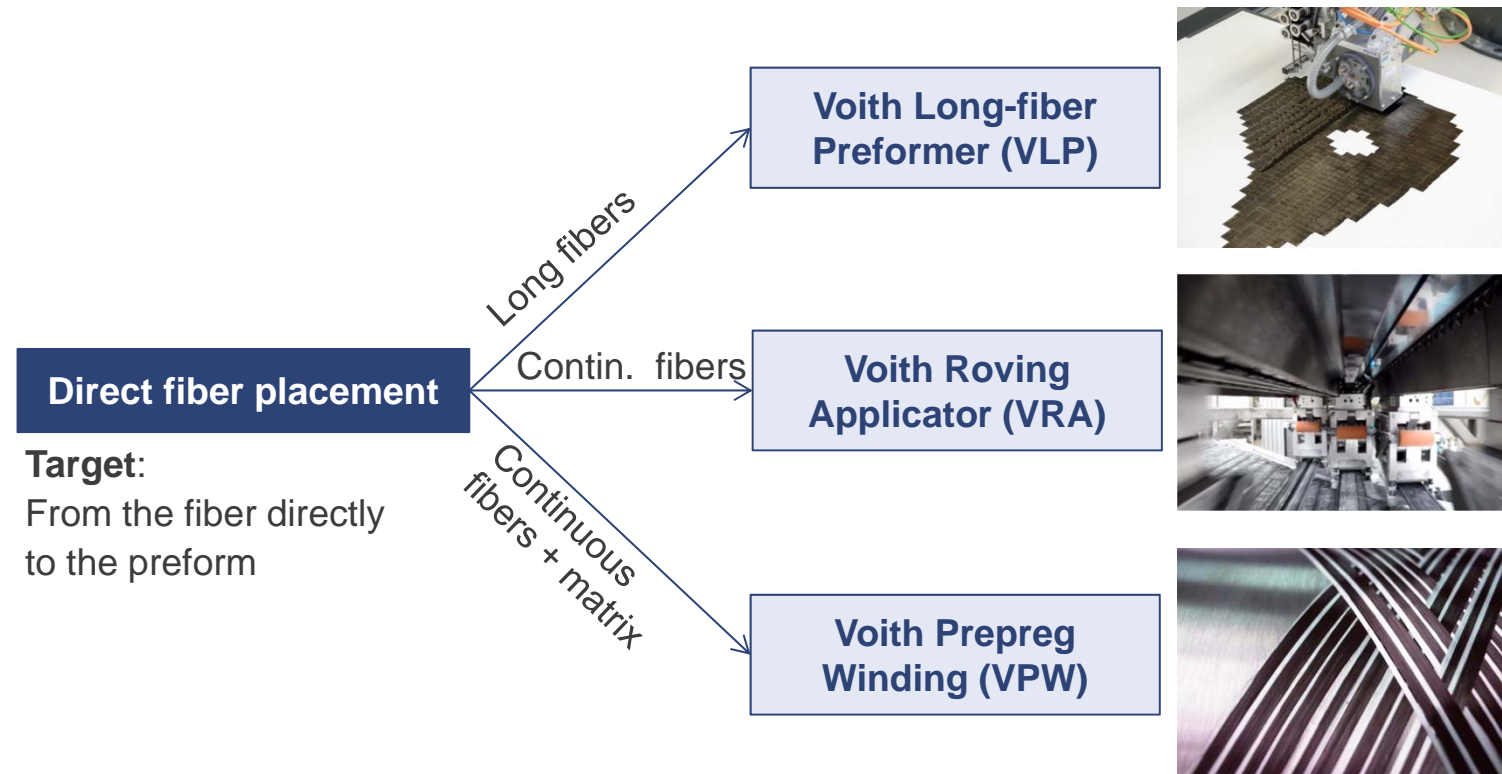


Cost reduction through eliminating and optimizing process steps

¹ Process chain for large-area and complex components with thermoset or thermoplastic polymers

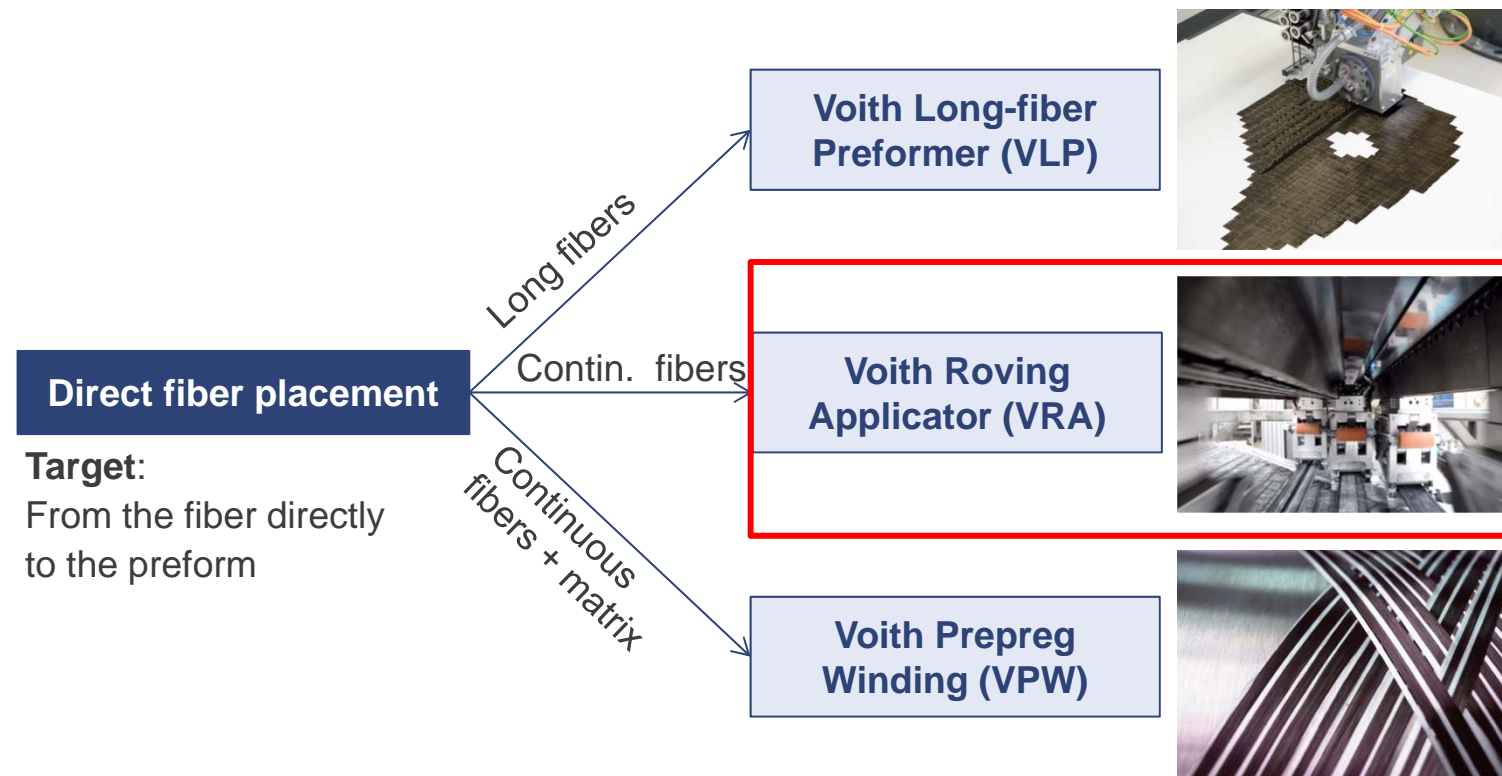
Voith Solutions Preforming

Overview: Voith direct fiber placement solutions



Voith Solutions Preforming

Overview: Voith direct fiber placement solutions





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 light weight 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

Contact:

David Weinberg

Head of Sales & Business Development

Tel.: +49 89 32001 – 800

David.Weinberg@voith.com



VOITH

Engineered Reliability