Pushing boundaries in pultrusion with Polyurethane

Benedikt Kilian
COVESTRO-PUR-R&D
Pultrusion is a manufacturing process for the continuous production of fiber reinforced plastics.

- Continuous process
- Constant profile cross section
- Linear profiles
- Preferably load in profile direction

* [Jiangsu Top Composite Technology Co., Ltd.]
### Pultruded Polyurethane Composites (PUL) Properties in comparison with other materials

<table>
<thead>
<tr>
<th>Durability</th>
<th>Mechanical Stability</th>
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</thead>
<tbody>
<tr>
<td>PUL ~ Aluminum ~ PVC &gt;&gt; Wood</td>
<td>[E-Modul in GPa]</td>
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<tr>
<td>Dimensional Stability</td>
<td>Thermal Insulation</td>
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<tr>
<td>[thermal expansion coefficient in $10^{-6} \text{1/K}$]</td>
<td>[thermal conduction coefficient in W/mK]</td>
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Global Pultrusion market by segments

Market volume: ~260 kt, 1.5 Bn $ (2015); CAGR 2016-2021: ~4.6%
Pultrusion at Covestro

… a global full solution provider

**Products**
Aromatic and aliphatic polyurethane resins
- Baydur®
- Desmocomp®

**Support**
Service beyond chemistry

**Know-how**
Chemistry, processing and business

**Development**
Pushing boundaries in innovation

Locations:
- Leverkusen
- Pittsburgh
- Shanghai
Pultrusion with Polyurethane (PUR)

The unique combination of processing and material properties vs. standard resins offers new opportunities

The good material properties of PUR allow to …
- reduce wall thicknesses
- use less complex fiber reinforcements
- increase profile complexity

The special chemistry of PUR allows to …
- cure fast and produce at high line speeds
- decrease emissions and the influence of the environment

REDUCED PART COSTS AND NEW POTENTIAL APPLICATIONS

Lower material consumption & increased productivity

Cost calculation

Customer feedback & success stories
Success Story 1
Replacing unsaturated polyester resin in cable trays in China

REASON FOR SUCCESS:

solution with Polyurethane is cheaper than with unsaturated polyester due to the better mechanical properties (reduced wall thickness) and higher productivity.

[Hangzhou Tianyun Technology]
SUCCESS STORY 2
Success Story 2
Replacing Aluminum window and door applications in Europe

REASON FOR SUCCESS:
solution with Polyurethane offers better properties (insulation, air tightness, sound insulation) at comparable costs.
COVESTRO HAS ADDITIONAL KNOW-HOW …
Covestro has additional KNOW-HOW …

… regarding various aspects of Pultrusion

- One decade experience
- Fiber sizing
- Coating
- Business
- Patents
- Processing
SUPPORTING our customers …

… leads to a strong partnership
Ongoing DEVELOPMENT projects
… prepare Covestro for a successful future

- Carbon fiber pultrusion
- Technology development
- Application case studies
- UV-stable resin development
- Pigmentation
- Catalyst development
The future of Pultrusion: industrialization
Pushing boundaries to tap the full potential

**CHEMISTRY:**
- High line speed systems
- Improved process & part properties
- Systems for new fibers & applications
- 1K Polyurethane Systems

**TECHNOLOGY:**
- High line speed machinery
- Process & quality control
- High process stability

**SERVICE & SUPPORT:**
- Injection box & die design
- Processing know-how
- Application development

**PROCESS BROADENING:**
- Pultrusion with different fibers
- Increase profile complexity

**ENABLING NEW APPLICATIONS AND MARKET SEGMENTS**
Approach to overcome the challenges: partnering along the value chain

Machine Supplier

Coating Processors

Pultrusion Companies

Research Institutes

Recycling Companies

Designers & Architects

Potential (End-) Customers

Fiber & additives Suppliers
Key take aways

The outstanding material properties of pultruded profiles make them suitable for many applications.

Polyurethane resin with it’s unique combination of processing and mechanical properties is in many cases the most cost effective solution for the industry.

Across all regions and all business units Covestro is a FULL SOLUTION provider for Pultrusion, offering various PRODUCTS, providing EXPERIENCE and KNOW-HOW, SUPPORTING our customers and constantly developing INNOVATIONS.
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Thank you!

Benedikt Kilian
COVESTRO-PUR-R&D