# DSM Engineering Plastics (Advanced Thermoplastic Composites)

ALV Composites NL Brightlands Materials Center November 27, 2019

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NUTRITION · HEALTH · SUSTAINABLE LIVING



### About Royal DSM Bright Science. Brighter Living.

DSM is a global purpose-led, science-based company specializing in Nutrition, Health & Sustainable Living.

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Our purpose is: to create brighter lives for all.

DSM was founded in 1902 and is listed on Euronext Amsterdam



### Quick facts and figures

### DSM Engineering Plastics and DSM overall





# Bright Science in advanced materials





# Quick facts and figures

### Global footprint to support customers across the globe



### Industry Mega Trend: New Technology (1/2) Rapid shift to New Mobility, Connectivity & Artificial Intelligence



### Industry Mega Trend: New Technology (2/2) Technology shift asks for new and innovative high-performance materials



Connectivity & Safety ADAS & Autonomous

Shared Mobility

- Increasing demand for higherperformance materials:
  - Increased innovation challenge
  - Increased complexity
- Demand for new applications including radically new designs (thinnovation, miniaturization, simplification)
- Demand for functional materials

DSM Engineering Plastics supports with:

High-performance plastics for automotive and E&E components as Connectors, Sensors, Power Distribution

Strong application and technology support for OEMs and Tiers

Application-specific CAE simulations for mold flow, mechanics, thermal and EMI shielding characteristics



# Bright Science in advanced materials

### Co-developing throughout the value chain



# Advanced Thermoplastic Composites

Continuous Fiber Reinforced Thermoplastic (CFRT) composites





Confidential

### Portfolio Asset: CFRT upgrades DEP portfolio in structural, metal-replacement applications





# **UD** Tapes

### Applicable DSM Materials







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# Why ATC?

### Weight Loss is still the most effective emissions reduction technology



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Source: A.T. Kearney

# DSM is globally recognized for sustainability performance.

# Leading the way in integrating sustainability across business and operations





# **UDT Physical Characteristics**

Tape Specifications	Typical Values	Remarks
Thickness	0.10-0.25 mm	STD: +/-0,02 mm
Width	Up to 1000 mm (300 mm Nominal)	Slitting to achieve narrow width
Length	Any length possible	300 m (nominal)
Slitting	≥ 6 mm +/- 0,1 mm	1 mm incremental step

- ✓ Very good spreading of fiber bundles within the polymer matrix.
- $\checkmark$  No voids observed
- ✓ Fibers fully impregnated
- ✓ Fibers are all aligned straight no undulation observed



### Standardization





#### PRESS RELEASE

September 2019

Opel ...) exists.

### Characterization of continuous fiber reinforced thermoplastics (cFRTP) within CAMPUS-database

Frankfurt – For more than 30 years leading material suppliers use the CAMPUS database to support their customers with important and high quality material data of their materials. Due to a consequent compliance of test standards, CAMPUS provides the best data quality worldwide. This measure ensures comparability of the participants' data. So far, CAMPUS provided mainly data of injection moulding grades. Continuous fiber reinforced thermoplastics were excluded, since there no industrial wide standard characterization for this material group. Since 2015 an AVK task force of material suppliers, under the umbrella of AVK – Federation of Reinforced Plastics (AVK), concerns itself with this topic. Its main goal is to formulate a generally accepted procedure for characterizing continuous fiber reinforced thermoplastics, and if not already existing, standardize procedures on an international scope. Well-known manufacturers are collaborating directly within this task force (Arkema, Bond Laminates/Lanxess, Covestro, DSM, Evonik, Mitsui Chemicals, Profol, Sabic, Solvay). The Institut of Composite Materials (IVW) does leadership and scientific supervision.



# Market Approach

### Visual Presentation of A Supply Chain Gap



# ATC Materials

### **Applications**

- UD tapes can be woven and/or stacked into plates (0.2 mm to 5 mm thick) and shaped by thermoforming/over-molding
- The UD tapes can be used as inserts in injection molding
- The UD tape can be wound (filament-winding) into pipes of varying cross-section profiles
- Metal-Composite Hybrids (Composite Patches)





# Our Approach

A product-development process that can drive the metalcomposite conversion with a high degree of success

- Modest raw-materials to UD Tape conversion costs (\$)
- Cycle-times approx. 1 minute (like injection-molding \$)
- Extensive/Exotic retooling not required

Key technology-partnerships in the value chain:

- Partnerships for UD Tape Winding, Tape-placement & Thermoforming and CAE simulations of UD Tape based composites behavior in customer applications
- Key OEM/TIER market-pull for PTO opportunities



# Applications (History 2012-2016)









# **Applications**

ATL + Thermo-form + Over-mold





Winding





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# Circularity

### Cradle to Cradle Use





- Grinded material sieved over 3 mm mesh
- No issues with feeding regrind materials in injection molding



# Circularity

### Comparison with Commercial Compounds

	Regrind	Q-HG10*	Retention (%)
Modulus (GPa)	15	15	100
Tensile strength (MPa)	200.2	215	93
Strain At Break (%)	2.4	2.9	83

\* Average value calculated from >15 production batches



Consistent and reproducible test-data



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### Conclusions

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### Trend Toward Multi-Material Design







# Summary

### Leveraging UD tapes

- An integrated approach to parts design, material selection and manufacturing process is key to metal-to-composite conversion
  - Short Cycle Times
  - Low Conversion Costs
  - Low Re-Tooling Costs
- 2. Emphasis on light-weighting (multi-material approach)
- 3. UD tapes are the building blocks of ATC
- 4. External partnerships optimize time-to-market





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