

Local reinforcement with Celstran UD Tapes

4a Technologietag

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Celanese Introduction







Local reinforcement with Celstran UD Tapes

BOGE – TP Composite Brake Pedal





OEM: Porsche

Platform: 911 & 9J1

Tier1: BOGE Rubber & Plastics Group

Material: UD Tape Celstran CFR-TP PA6-GF60-03-305BLK PA6 sGF Granulate PA6 Organo Sheet

Target:Weight and cost savingMetal replacement

Development through Partner Network





Comprehensive know-how in materials, design, simulation and process engineering was bundleed





Source: Gutowski [1]

Celstran Manufacturing Process – Pultrusion





Celanese Corporation

Celstran[®] UD Tapes

- Material
 - Each fiber fully impregnated —
 - Constant fiber dispersion —
 - Superior mechanical properties —
- **Benefits**
 - Stiffness, Strength, Impact Resistance —
 - Structural Performance _
 - Local Reinforcement _
- Production
 - Pultrusion Melt Impregnation —
 - Rolls in: 305 mm width & 0,30 mm thickness —







Polymer Matrix					
		HDPE	PP	PA6	PA66
	mp (⁰C)	127	173	220	255

Reinforcing Fiber (Type - Weight %)	E-Glass	GF-70	GF-60	GF-60	GF-60
			GF-70		
	HT Carbon Fiber	CF-65	CF-60	CF-60	CF-60

Focus on Automotive



Developmental Grades

Successfull path of development with our partner BOGE





Benchmark – Why Celstran CFR-TP PA6-GF60-03 ...









Determination of stress-strain curves of following material combinations

- Organo sheets and injection molding compound
- UD Tape and injection molding compound
- Organo sheets and UD Tape

Simulation of organo shell and rib structure



Source: Boge







Multiaxial tailored design according to forces and loads



Source: Boge

UD Tape Placement Process







Manufacturing Process

- Step 1 Thermoplastic tape layering process
- Step 2 Preheating of the tape layer
- Step 3 Transfer into the Mold
- Step 4 Over molding of Composite layer
- Step 5 Part inspection and labeling

Challenge

 Interaction of all three components without delamination and temperature degradation



Source: mai

Summary



Weight and cost savings

- 60% weight reduction to steel design
- Final part weight 600g
- 30% weight reduction by using a tailored UD Tape design
- Reduction of wall thickness
- Cycle time reduction
- ► Higher number of brake pedals would reduce costs even further







Thanks for Your Time Any Questions?



Contact

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CELSTRAN® CFR-TP PA6 GF60-03 - PA6

Description

Celstran® CFR-TP PA6 GF60-03 is a 60% E-glass by weight polyamide 6 (nylon 6) continuous fiber (uni-directional) reinforced thermoplastic composite tape. This material exhibits a high strength-to-weight ratio, excellent toughness and impact resistance. It is well suited for industrial, automotive and sporting goods applications where strength, toughness and cost are critical, as well as ease of processing. The material is available in natural and black colors. Alternate tape widths and thicknesses may be available.

Physical properties	Value	Unit	Test Standard
Density	1690	kg/m³	ISO 1183
Fiber Content	60	% by wt.	-
Fiber Volume	40	% by vol.	-
Tape Thickness	0.3	mm	-
Tape Width	305	mm	-
Tape Areal Weight	507	g/m²	-
Fiber Areal Weight	304	g/m²	-

Mechanical properties (Tape)	Value	Unit	Test Standard
Tensile Strength, 0°	679	MPa	ASTM D 3039M
Tensile Modulus, 0°	29.7	GPa	ASTM D 3039M
Tensile Strain at Failure, 0°	2.36	%	ASTM D 3039M
Flexural Strength, 0°	752	MPa	ASTM D 790/Tape
Flexural Modulus, 0°	32.1	GPa	ASTM D 790/Tape
Flexural Strain at Failure, 0°	3.12	%	ASTM D 790/Tape