

Presentation of the ICF-Development

ICF carbon fiber reinforced compounds

Thermoplastic materials for production of lightweight structural components

ICF Compounds とは？：

◆ CFクロス廃材を活用した射出成形材料



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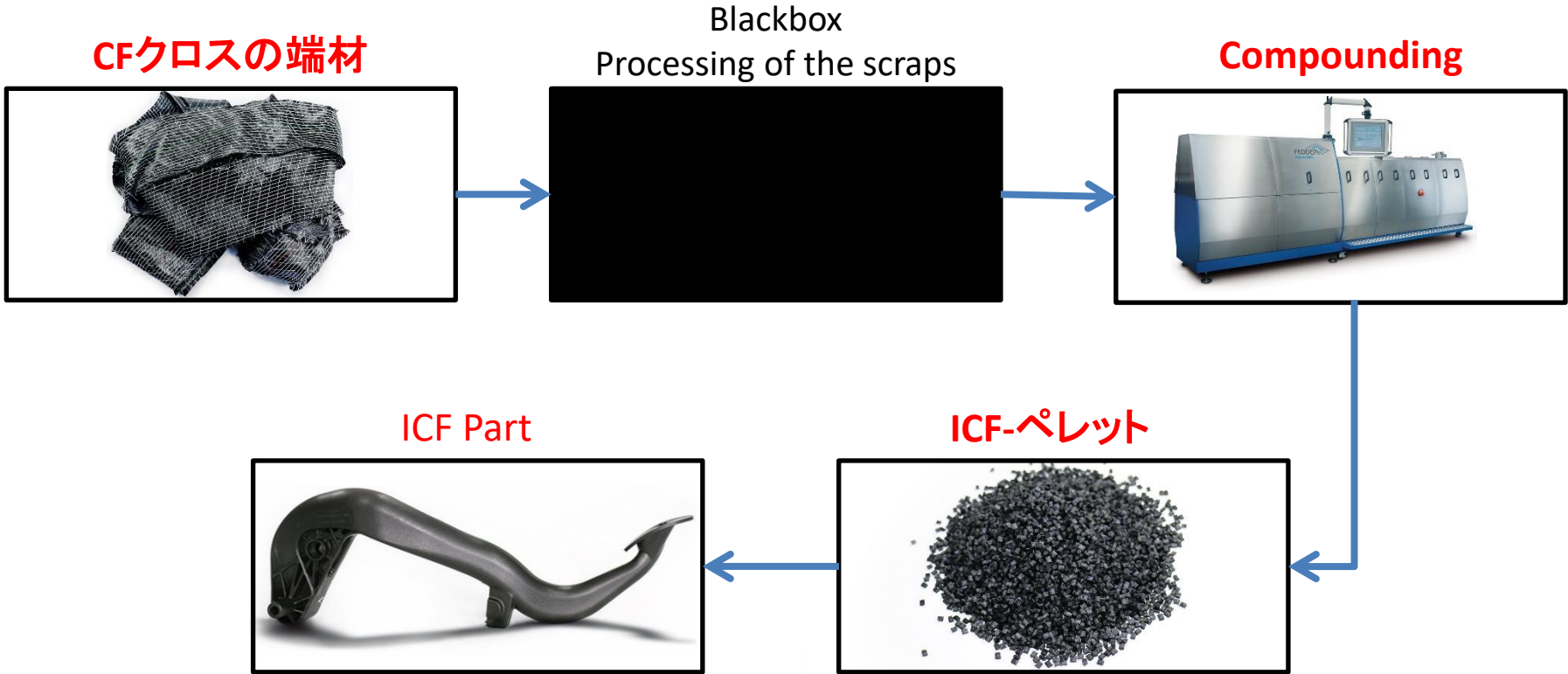
Freude am Fahren



Production plant Niederzissen



Research and innovation center Munich



- Competitive price: 競争力ある価格 (GF強化材質の代替が可能な価格)
- Good electrical conductivity: 良好な導電性
- Good thermal conductivity: 良好な熱伝導性
- Excellent stiffness and flexural stiffness: 良好な剛性
- Good flexural stress: 良好な曲げ強度
- Low thermal expansion coefficient: 小さい線膨張係数
- Low density: 低比重 (GF強化材料比較)
- Good tribological properties (low wear) 良好なトライボロジー性能 (摺動特性)

- JEC Innovation Award 2016
with BMW and Grammer
- Parts: Carrier Center Console



JEC: 欧州最大のComposite展示会



- SPE Award 2015
1st place
- Parts: Clutch Pedal



SPE : Society Plastic Engineers



- **AKROMID A3 ICF 10 black (5117); Alternative: A3 GF 30 1 black (2385)**
材質: ICF 10%-PA66、GF30%-PA66からの切替
- **BMW F 54 Mini Clubman**
- **Advantage: 18% less weight and same stiffness**
利点: 同等な剛性で18%重量低減



WIT成形法で中空構造



- AKROMID B3 ICF 15 black (5026); Alternative: B3 GF 30 1 GIT schwarz (4599)
材質: **ICF15%-PA66**、GF30%-PA66からの切替
- Advantage: 10% less weight; 25% higher stiffness
利点: 25%の剛性アップと10%重量低減の両立
- SPE-Award: highest award for power train
SPE受賞: Power train部門の最高賞を受賞

Properties	Unit	AKROMID® B3 ICF 20 1 L	AKROMID® B3 ICF 20 1 L	AKROMID® B3 ICF 20 1 L
Shot method		Zero value	Short shot	Full shot
Holding pressure		with holding pressure	without holding pressure	without holding pressure
Partial fill			Partial fill	
Blowing agent	%	3.5 AF-Complex® TM	3.5 AF-Complex® TM	3.5 AF-Complex® TM
Tensile modulus	MPa	12,510 [100 %]	10,660 [85 %]	12,200 [97 %]
Flexural modulus	MPa	12,100 [100 %]	12,240 [101 %]	12,260 [101 %]
Flexural strength	MPa	202 [100 %]	185 [92 %]	198 [98 %]
Flexural strain	%	2.7	2.4	2.6
Weight reduction	%		13	4
Density	g/cm³	1.10	0.96	1.06

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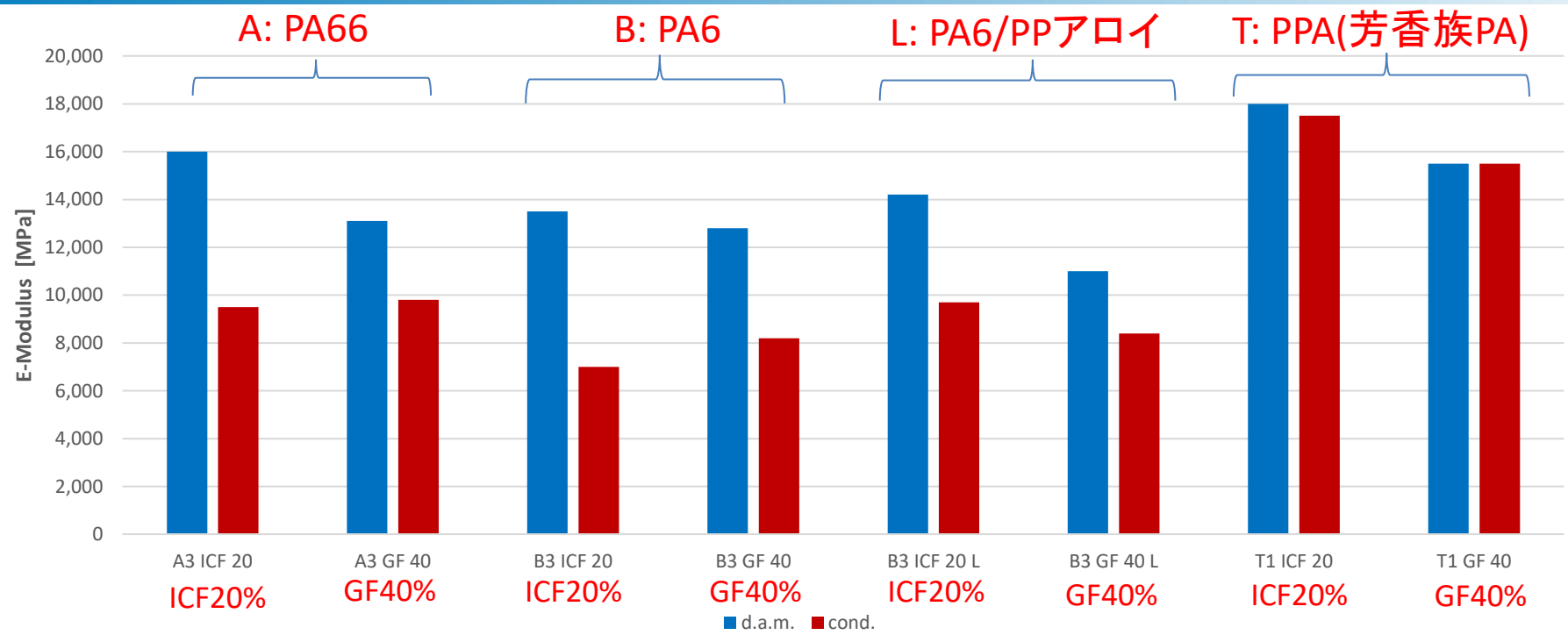




- AKROMID T1 ICF 30 black (5148) 材質: ICF30%-PPA (芳香族ナイロン)
- Automotive application 車載用途
- Replacement of metall screw 金属スクリューからの切替
- Advantage: **80% less weight** compared to metall screw but same security for assembly
利点: 80%重量低減(同等の組立安全性下)

Polymer matrix	Modification	Reinforcement: ICF
AKROMID® A (PA6.6)	1: heat stabilized 4: hydrolysis/ chemical stabilization 5: high heat stabilized 7: adhesion modified L: Lower density XTC: Extra high thermal compatibility S1: Cold impact modified RM-D: Reduced moisture, design RM-M: Reduced moisture, mechanical GIT: Gas injection technology WIT: Water injection technology TM: Tribologically modified	10-40%
AKROMID® B (PA6)		
AKROMID® C (PA6/66)		
AKROMID® T1 (PPA)		
AKROMID® T5 (PPA, T _g is 125°C)		
AKROLOY® PA (PA6.6 + PA6I/6T)		
AKROLOY® PARA (Polyarylamide)		
AKROTEK® PK-VM (Polyketon)		

Specialities like **RM-D, RM-M, GIT, WIT** can be offered in a combination with some of the polymer matrices



“d.a.m.” = dry as molded test values = residual moisture content < 0.10 % → 青棒グラフ(絶乾)

“cond.” test values = conditioned, measured on test specimens stored according to ISO 1110 → 赤棒グラフ(吸湿)

Comparison GF versus ICF GF強化グレードと比較

	Test method	Unit	AKROMID® A3 ICF 15 schwarz (5056)		AKROMID® A3 GF 30 schwarz (2428)		AKROMID® A3 ICF 30 schwarz (5021)		AKROMID® A3 GF 60 schwarz (2432)		AKROLOY® PA ICF 30 schwarz (5269)		AKROLOY® PA GF 60 schwarz (2844)	
Properties			d.a.m.	cond.	d.a.m	cond.	d.a.m.	cond.	d.a.m.	cond.	d.a.m.	cond.	d.a.m.	cond.
Tensile Modulus	ISO 527-1/2	MPa	12,000	7,400	10.000	7,100	20,000	15,000	20,500	15,800	25,000	23,000	21.000	20,000
Tensile stress at break	ISO 527-1/2	MPa	170	110	200	130	220	170	260	190	220	200	275	245
Elongation at break	ISO 527-1/2	%	3	5	3	≥ 6	2	3.5	2	2.5	1.5	1.6	2,5	2.5
Charpy-Impact strength (23°C)	ISO 179/1eU	kJ/m²	45	65	85	16	55	70	85	95	50	50	100	95
Density	ISO 1183	g/cm³	1.20		1.36		1.28		1.71		1.29		1.72	

軽量化効果 12.5 %

25 %

25 %

Properties	Test methode	Dimension	AKROMID® A3 ICF 15 schwarz (5056)	AKROMID® A3 CF 15 schwarz (3912)	AKROMID® A3 ICF 30 schwarz (5021)	AKROMID® A3 CF 30 schwarz (3082)	AKROLOY® PA ICF 40 schwarz (5270)	AKROLOY® PA CF 40 schwarz (3639)
Tensile modulus	527-1/2	MPa	10.000	13.000	23.000	22.000	35.000	30.000
Tensile strength at break	527-1/2	MPa	145	185	220	240	250	260
Elongation at break	527-1/2	%	3	2	2	1,5	1,5	1,5
Charpy-impact strength (23°C)	179/1eU	kJ/m²	45	40	55	50	50	55