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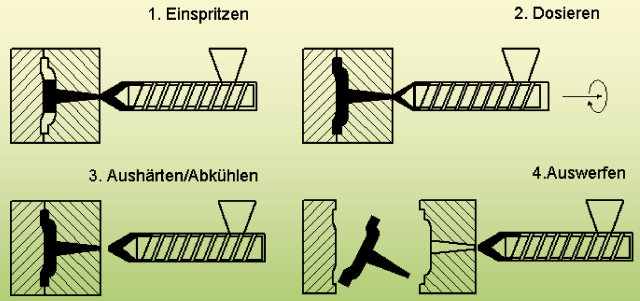
What's PP-NF?

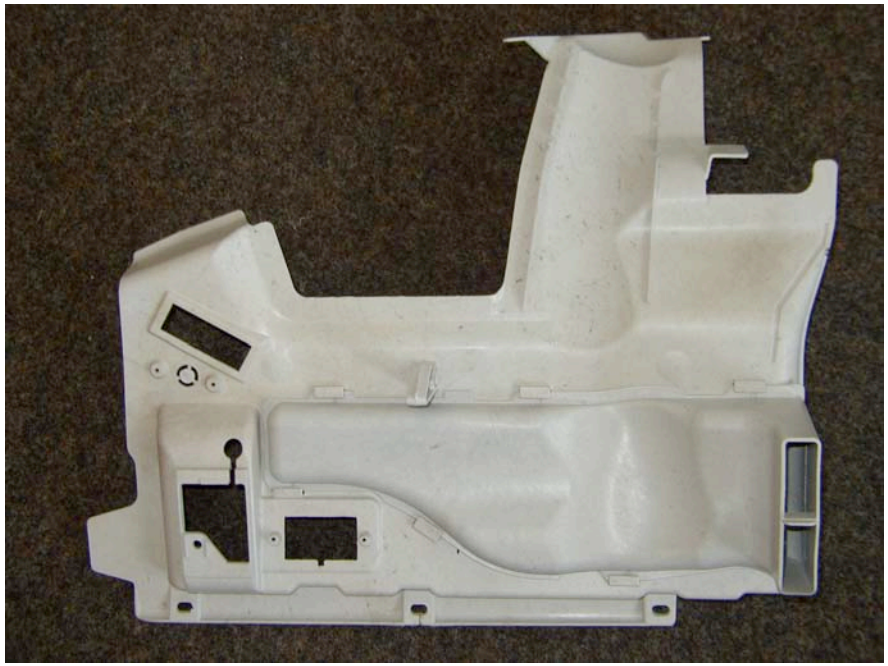
PP-NF is **p**oly**p**ropylene - **n**atural **f**ibre; a compound material with a polypropylene matrix, reinforced by natural (usually bast) fibres and a bonding agent.
This material can be stored, sold and transported as granules/pellets and be used quite like conventional materials.
The production technique for this material is primarily injection moulding, a standard technique used by thousands of factories world-wide.
The final part does not need to seem natural or unconventional at all (it can keep a natural flair with visible fibres), therefore it has many potential application in everyday life.

N-FibreBase

Injection moulding



Injection moulding is very widespread because much more complex shaped parts can be produced than with the press-moulding. Until 2004, natural fibres-reinforced compounds were almost exclusively produced with press-moulding.



What can be replaced with PP-NF ?

Natural fibres mostly replaced wood fibres in German automotive middle and upper class interieurs due to superior properties - as fibres in press-moulded parts.

For the PP-NF injection-moulding granules, other materials are likely to be partially substituted;

- ABS (Acrylnitril-Butadien-Styrol)
- PC-ABS (Polycarbonat - ABS)
- PP-Talcum (Polypropylen - Talcum)
- PP-fiberglass

Preliminary comparisons show that probably glass-fibre-PP compounds with low fibre contents (up to 20%) can be substituted by the very best PP-NF varieties. A very first commercial application with PP-NF in place of PP-glassfibre does exist.

Why PP-NF?

Three companies in Europe produce PP-NF granules in significant quantities since 2003; based on their information, we identified three major selling points for PP-NF:

In comparison with materials that have similar mechanical properties (ABS, PC-ABS, PP-Talcum), PP-NF are often superior in

price
cycle time
density

Why PP-NF?

We identified further, less important reasons why to substitute PP-NF for conventional compounds:

- Absence of shrinkage and warpage
- Fibres oriented in all directions
- Good dimensional stability
- Very good thermal behaviour
- Lack of abrasion
- Well recyclable (for example advantages due to the EU „End of Life Vehicle Directive“)
- Simplified later production processes

nova-Institut round tests with 20 different natural fibre injection moulding granules from 11 different institutes and companies:

6 from Germany, 2 from The Netherlands, 2 from USA and 1 from France

Conducted by/durchgeführt von:

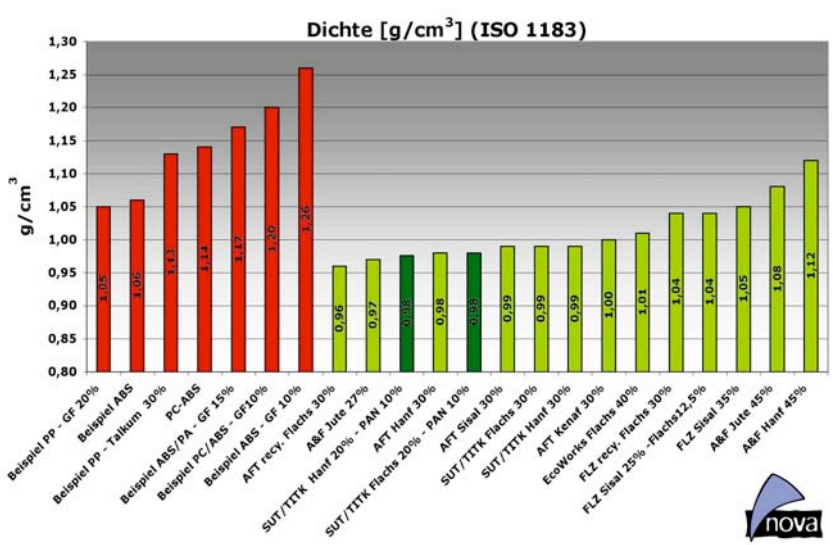
nova-Institut & Fibre Institute Bremen in 2002 und 2003

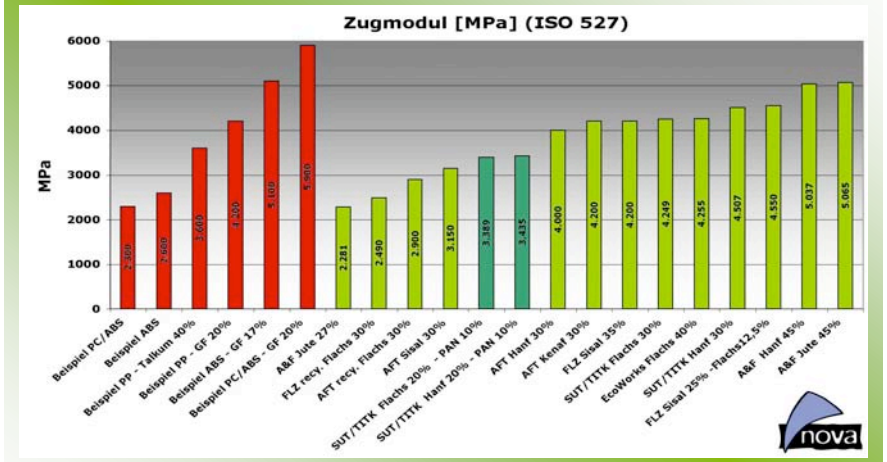
&

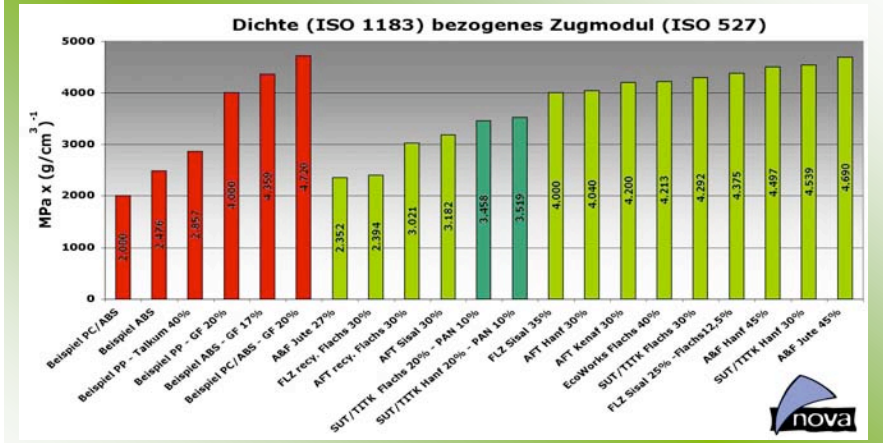
nova-Institut study for AVK TV e.V. (2004)

Part 1: Market Overview PP-NF (finished)

Part 2: Production tests (end of 2004)






Dichte (ISO 1183) bezogenes Zugmodul (ISO 527)
MPa x (g/cm³)⁻¹
5000
4000
3000
2000
1000
0
2.000
2.476
2.857
4.000
4.359
4.726
2.352
2.394
3.021
3.182
3.458
3.519
4.000
4.040
4.200
4.213
4.292
4.375
4.497
4.539
4.690
Beispiel PC/ABS
Beispiel ABS
Beispiel PP - Talkum 40%
Beispiel PP - GF 20%
Beispiel ABS - GF 17%
Beispiel PC/ABS - GF 20%
A&F Jute 27%
FLZ recy. Flachs 30%
AFT recy. Flachs 30%
AFT Sisal 30%
SUT/TITK Flachs 20% - PAN 10%
SUT/TITK Hanf 20% - PAN 10%
FLZ Sisal 35%
AFT Hanf 30%
AFT Kenaf 30%
EcoWorks Flachs 40%
SUT/TITK Flachs 30%
FLZ Sisal 25% -Flachs12,5%
A&F Hanf 45%
SUT/TITK Hanf 30%
A&F Jute 45%
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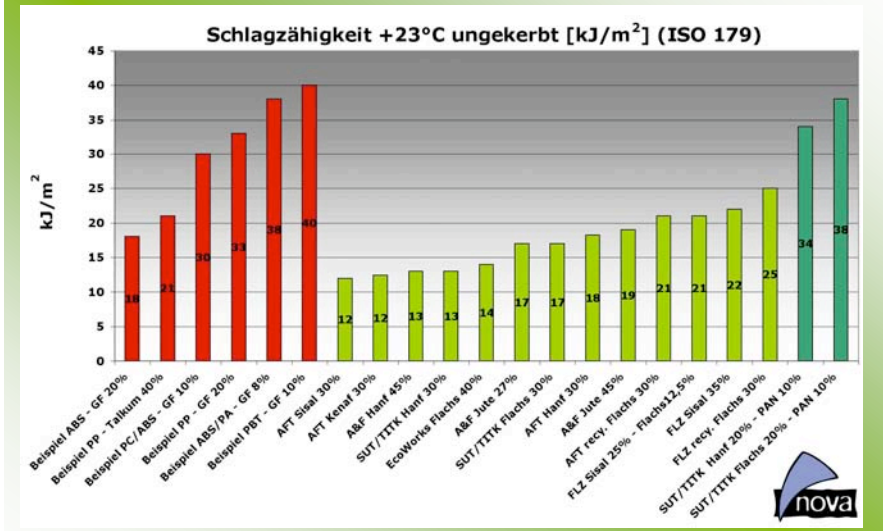
Schlagzähigkeit +23°C ungekerbt [kJ/m²] (ISO 179)
kJ/m²
45
40
35
30
25
20
15
10
5
0
18
21
30
33
38
40
12
12
13
13
14
17
17
18
19
21
21
22
25
34
38
Beispiel ABS - GF 20%
Beispiel PP - Talkum 40%
Beispiel PC/ABS - GF 10%
Beispiel PP - GF 20%
Beispiel ABS/PA - GF 8%
Beispiel PBT - GF 10%
AFT Sisal 30%
AFT Kenaf 30%
A&F Hanf 45%
SUT/TITK Hanf 30%
EcoWorks Flachs 40%
A&F Jute 27%
SUT/TITK Flachs 30%
AFT Hanf 30%
A&F Jute 45%
AFT recy. Flachs 30%
FLZ Sisal 25% - Flachs12,5%
FLZ Sisal 35%
FLZ recy. Flachs 30%
SUT/TITK Hanf 20% - PAN 10%
SUT/TITK Flachs 20% - PAN 10%
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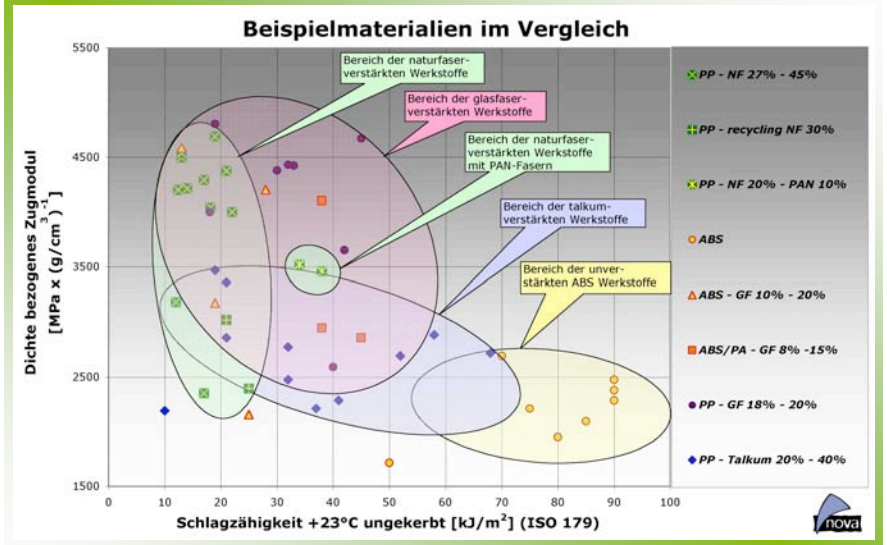
Beispielmaterialien im Vergleich
Dichte bezogenes Zugmodul [MPa x (g/cm³)⁻¹]
5500
4500
3500
2500
1500
0
10
20
30
40
50
60
70
80
90
100
Schlagzähigkeit +23°C ungekerbt [kJ/m²] (ISO 179)
Bereich der naturfaser-verstärkten Werkstoffe
Bereich der glasfaser-verstärkten Werkstoffe
Bereich der naturfaser-verstärkten Werkstoffe mit PAN-Fasern
Bereich der talkum-verstärkten Werkstoffe
Bereich der unver-stärkten ABS Werkstoffe
PP - NF 27% - 45%
PP - recycling NF 30%
PP - NF 20% - PAN 10%
ABS
ABS - GF 10% - 20%
ABS/PA - GF 8% -15%
PP - GF 18% - 20%
PP - Talkum 20% - 40%
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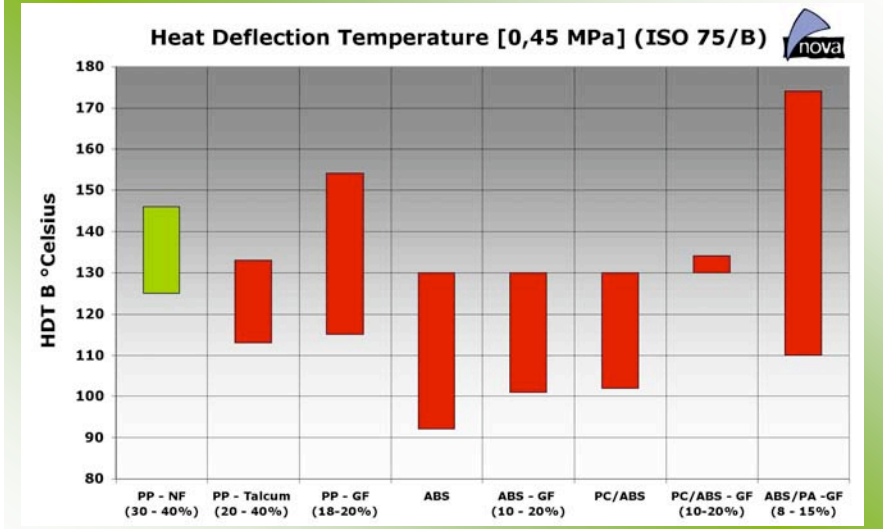
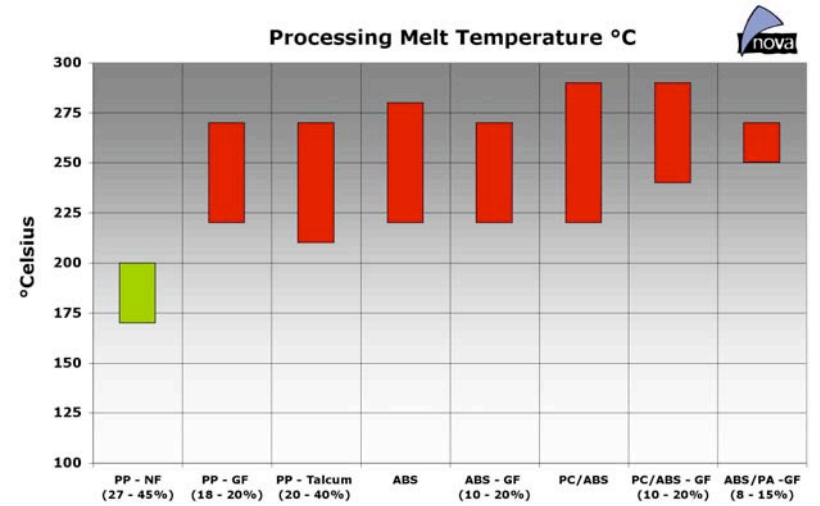
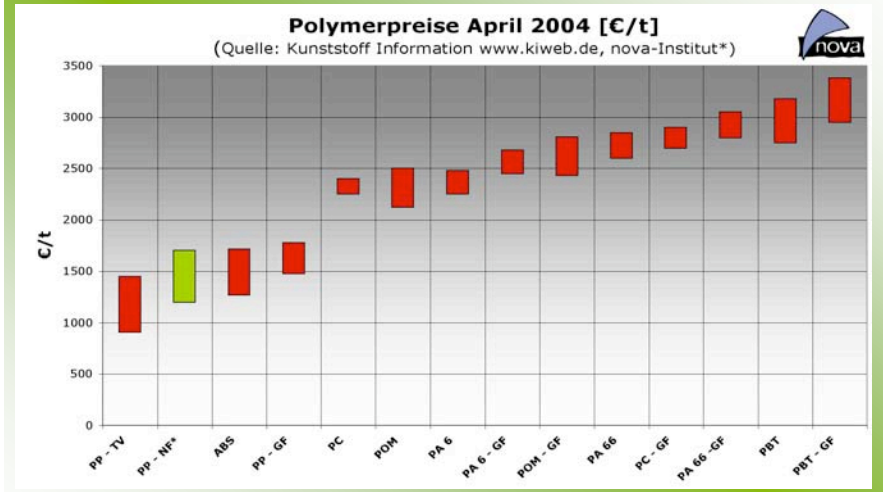

Heat Deflection Temperature [0,45 MPa] (ISO 75/B)
HDT B °Celsius
180
170
160
150
140
130
120
110
100
90
80
PP - NF (30 - 40%)
PP - Talcum (20 - 40%)
PP - GF (18-20%)
ABS
ABS - GF (10 - 20%)
PC/ABS
PC/ABS - GF (10-20%)
ABS/PA -GF (8 - 15%)
nova





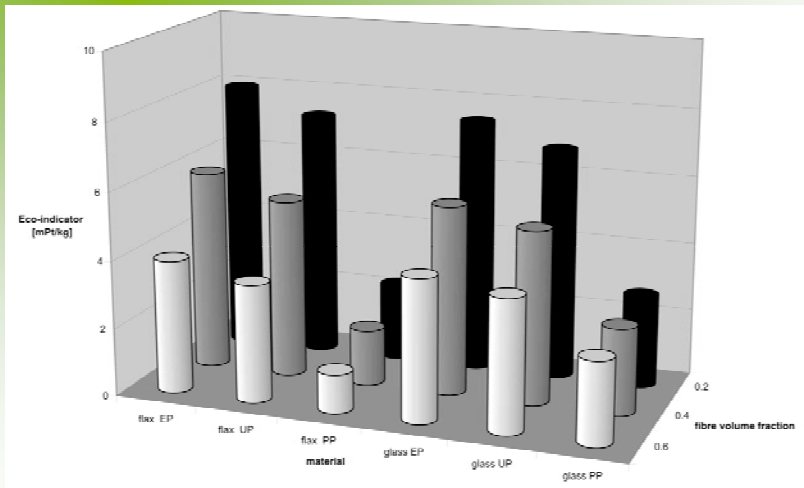
Production test sept. 2004

Faurecia - Polo-door panel with

PP-NF of FLZ (D) und A & F (NL)

Eco-Indicator

(Harriette Bos, A & F, Wageningen 2004)



nova‘ s PP-NF information campaign 2004-2005

Nova will lead a campaign that shall motivate large corporations in and outside the automotive sector to adopt PP-NF as product or raw material for their products.

All European PP-NF technology holders and sellers are invited to participate in the first phase, which is a detailed survey to find out which technologies are truly mature, what their properties (beyond those already known) are and what co-operations of partial solutions might be promising.

Later, the information will be presented to accelerate the expansion of PP-NF in and beyond the automotive sector.

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