Dow Wind Energy

Lowest in class resin pick-up core material technology for wind turbine blades design & production

JEC Composites Paris
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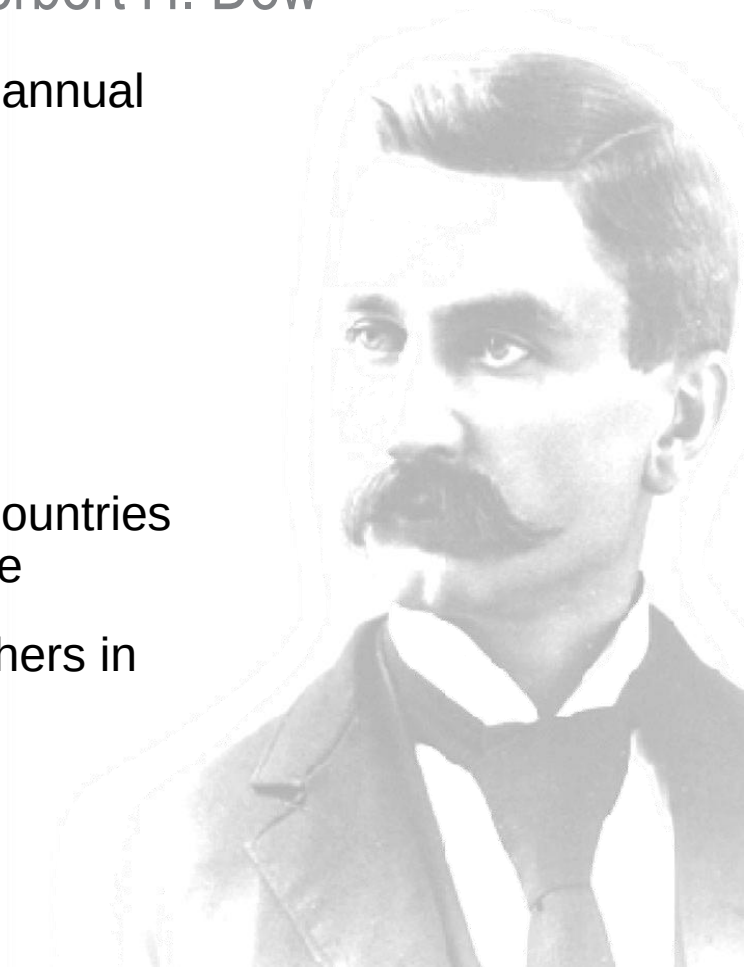
Global Application Leader
The Dow Chemical Company

DOW at a glance

"If you can't do it better, why do it?" – Herbert H. Dow

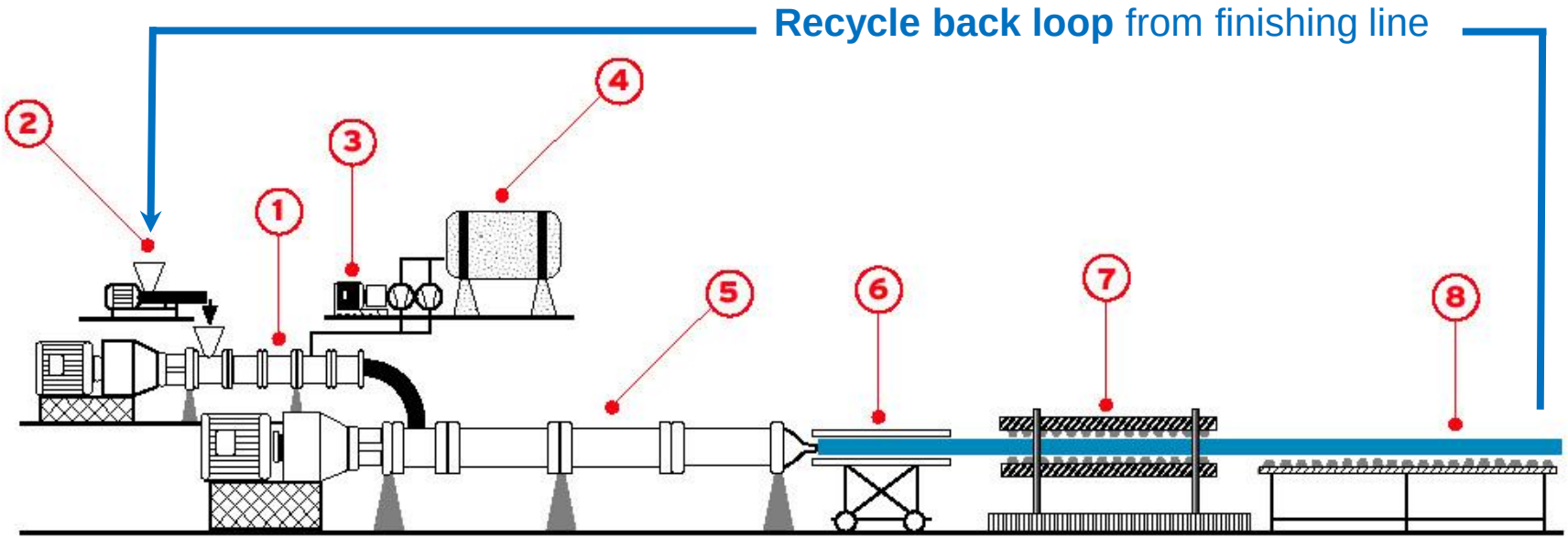
- A ***science and technology*** company with annual sales of $60 billion in 2011
- Founded in 1897 by Herbert H. Dow in Midland, Michigan
- Supplier of more than 5,000 products to customers in 160 countries
- Operator of 197manufacturing sites in 36 countries and employer of ~ 52,000 people worldwide
- R&D budget of $1.65 B with 7,000 researchers in more than 15 countries



Agenda

- Recyclability & other key characteristics of DOW COMPAXX™
- Static & dynamic performance vs. other foam cores
- Resin pick-up & weight reduction vs. other foam cores
- Cost savings

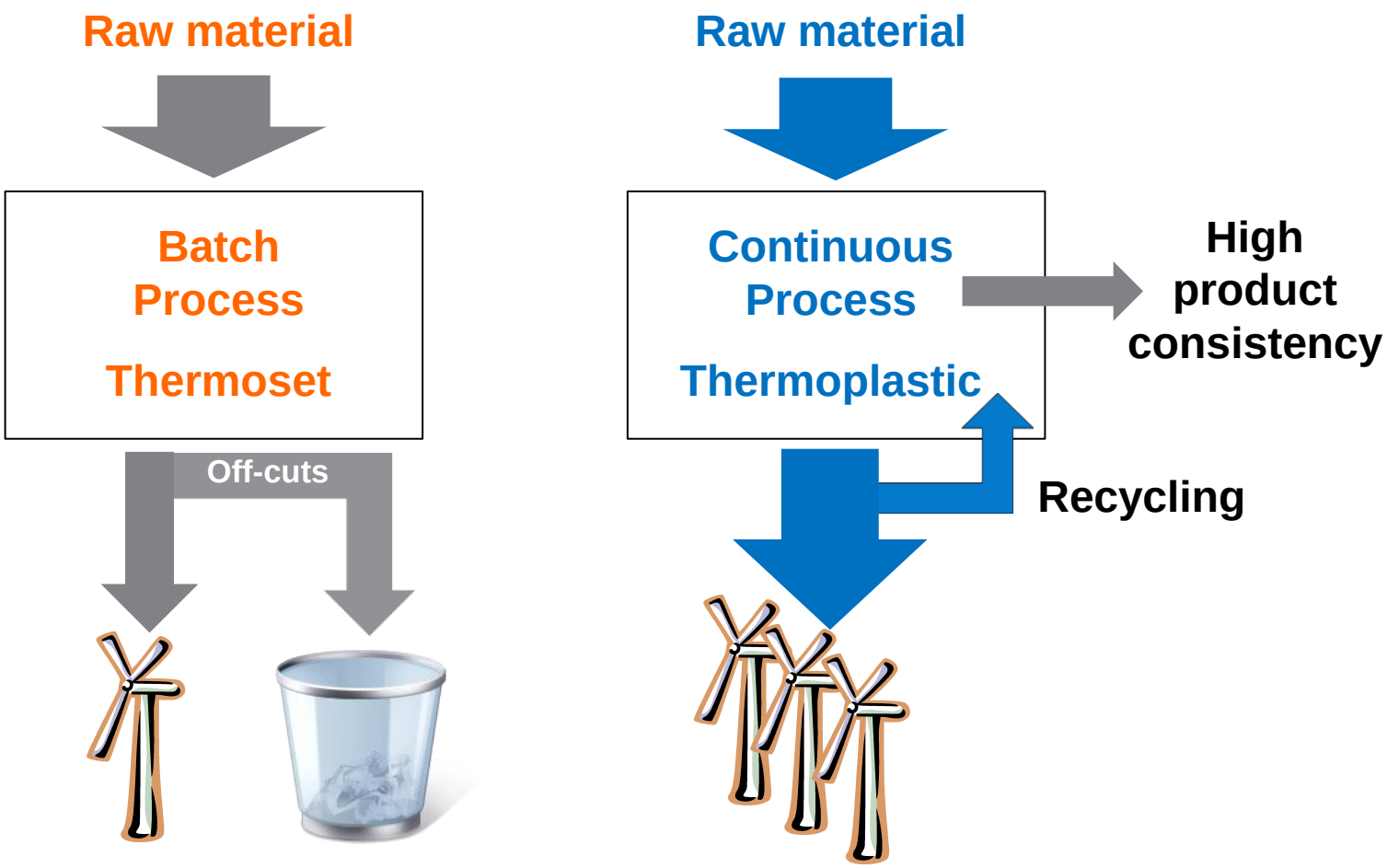
DOW COMPAXX™ production flow chart



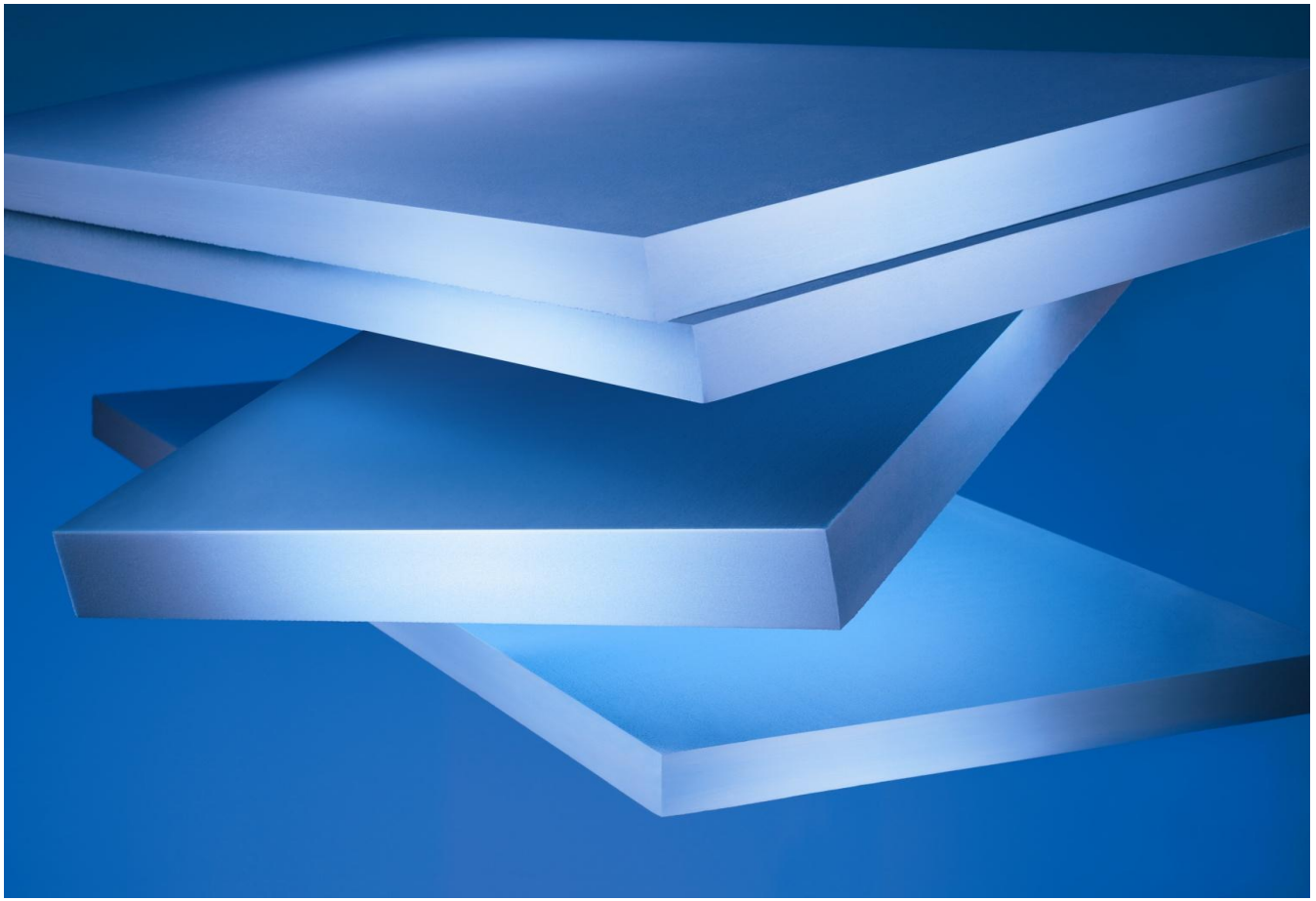
DOW COMPAXX™ is 100% recyclable

1 Extruder
2 Raw material input
3 Blowing agent pump
4 Blowing agent tank
5 Cooling system
6 Board calibrator
7 Pulling rolls
8 Cooling & finishing

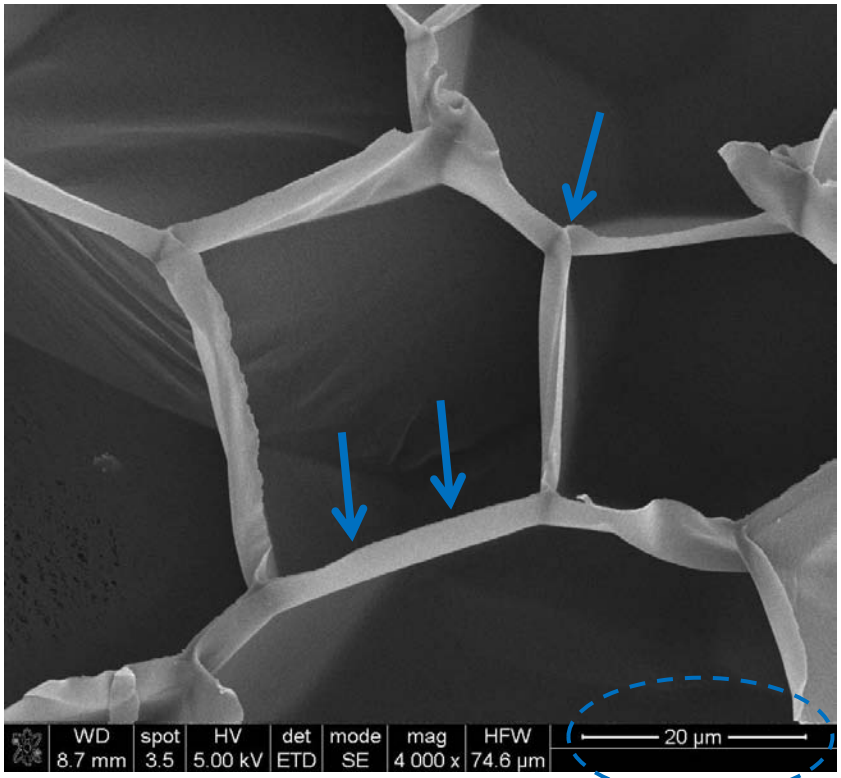
Processes comparison at a glance



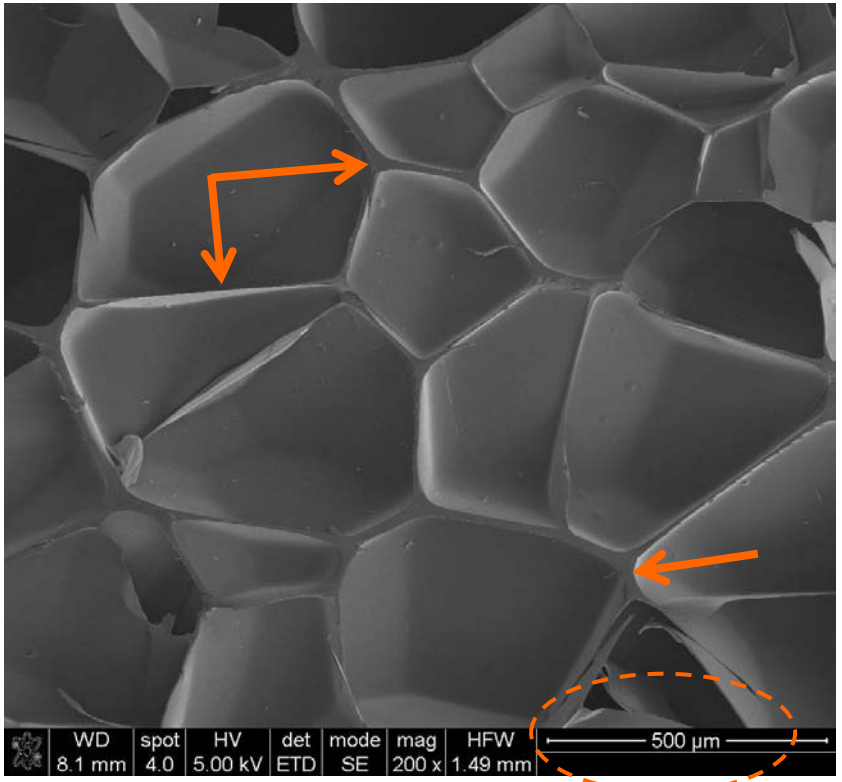
DOW COMPAXX™ 900



Mass distribution within foam



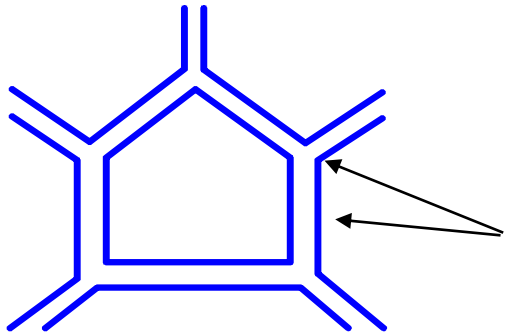
DOW COMPAXX™



PVC Foam

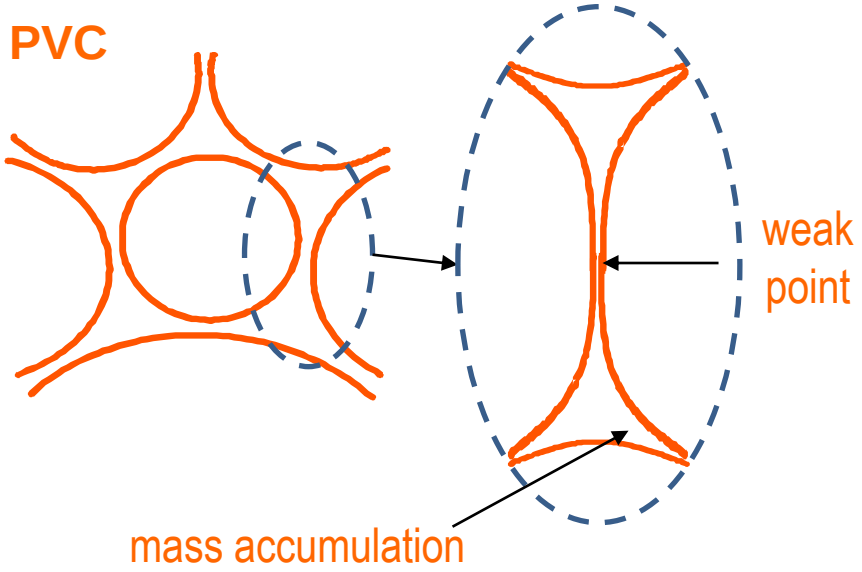
Mass distribution within foam

DOW COMPAXX™



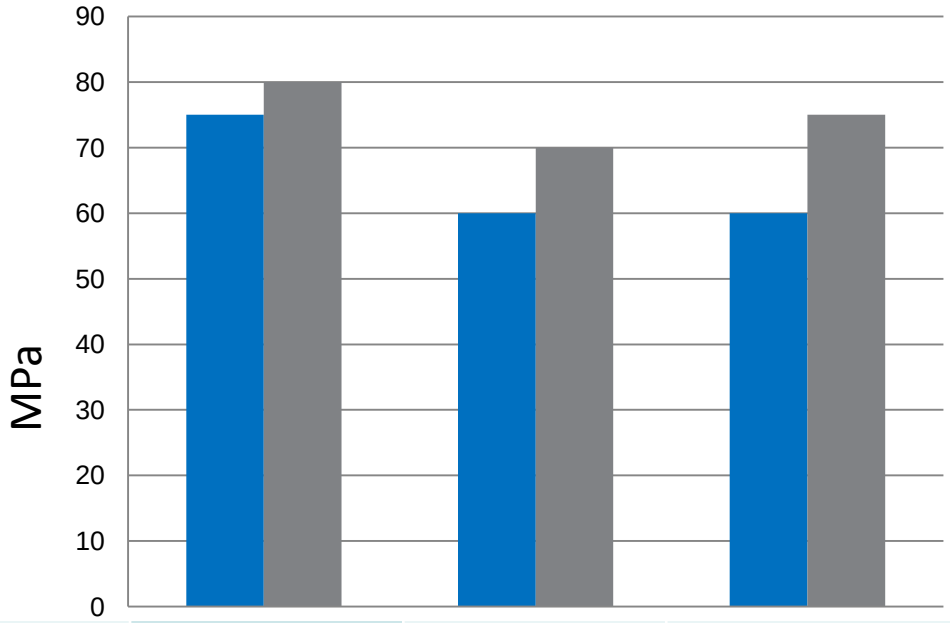
Homogeneous mass distribution
=
Optimum strength to weight ratio.

PVC



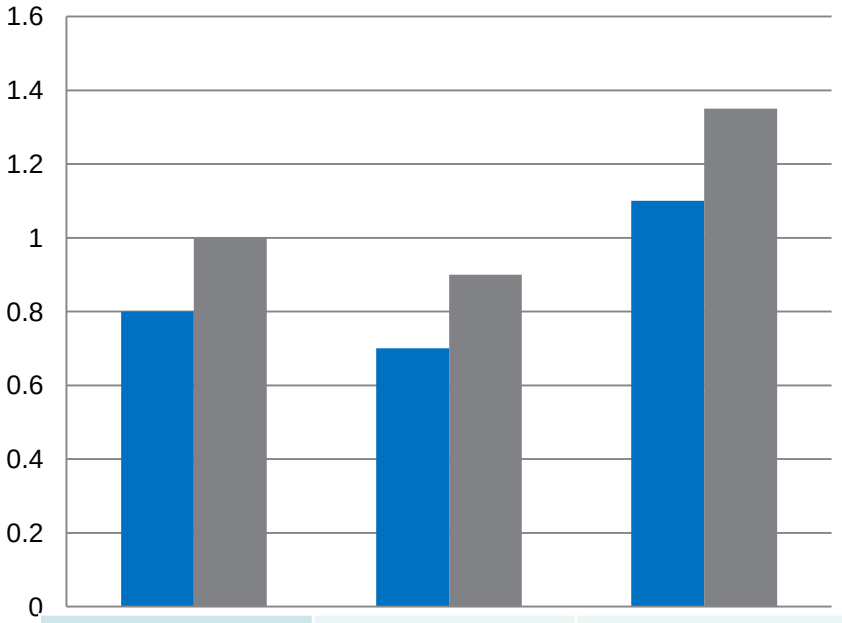
Mass accumulation at corners
=
Lower strength to weight ratio.

Compression Modulus (1)



	DOW COMPAXX™	PVC 60	PET 100
GL (2)	75	60	60
Typical	80	70	75
Density	60 kg/m^3	60 kg/m^3	110 kg/m^3

Compressive strength

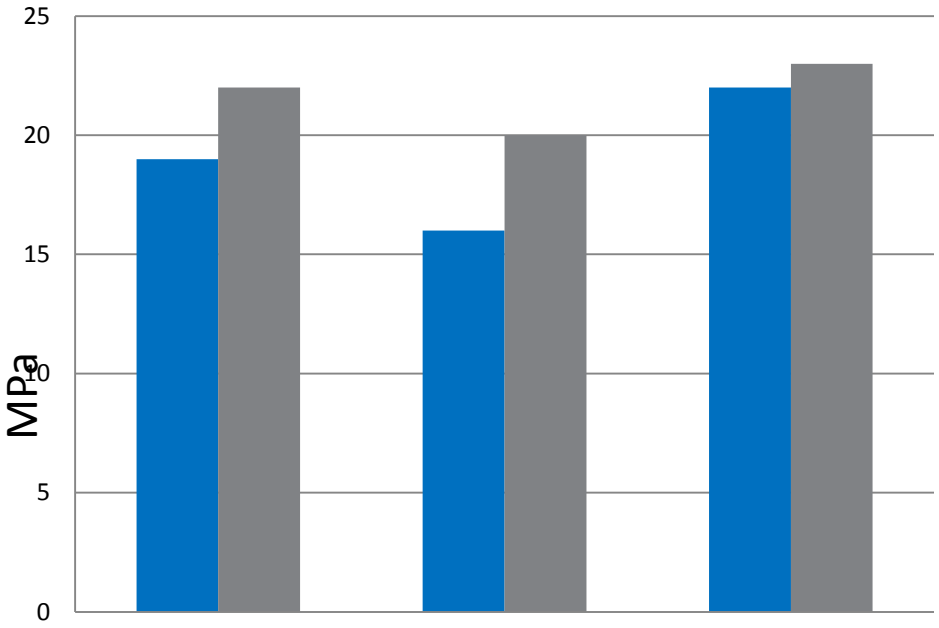


DOW COMPAXX™	PVC 60	PET 100
0.8	0.7	1.1
1.0	0.9	1.35
60 kg/m^3	60 kg/m^3	110 kg/m^3

(1) ASTM D1621-73 part B
(2) Germanischer Lloyd certificate

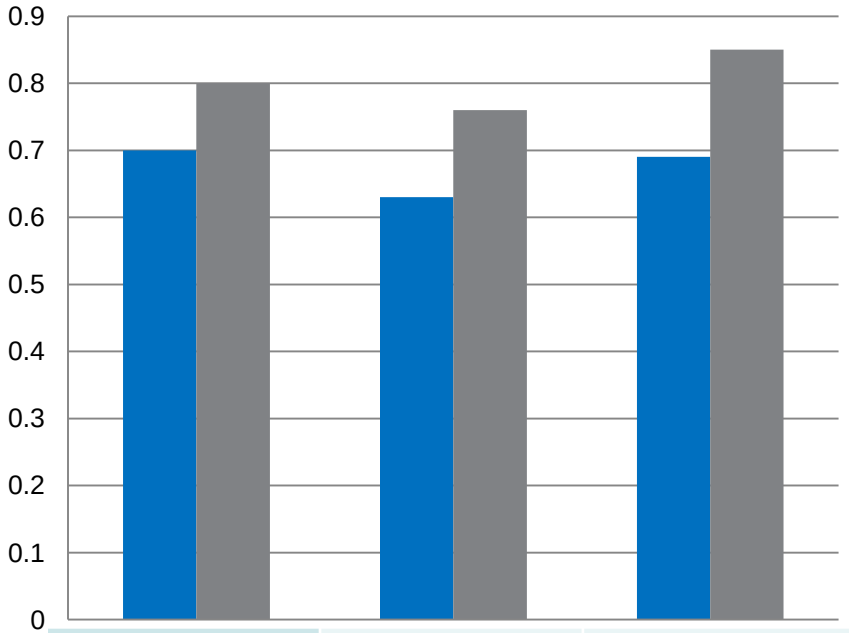
Dow Wind Energy

Shear Modulus



	DOW COMPAXX™	PVC 60	PET 100
GL (2)	19	16	22
Typical	22.0	20	23
Density	60 kg/m^3	60 kg/m^3	110 kg/m^3

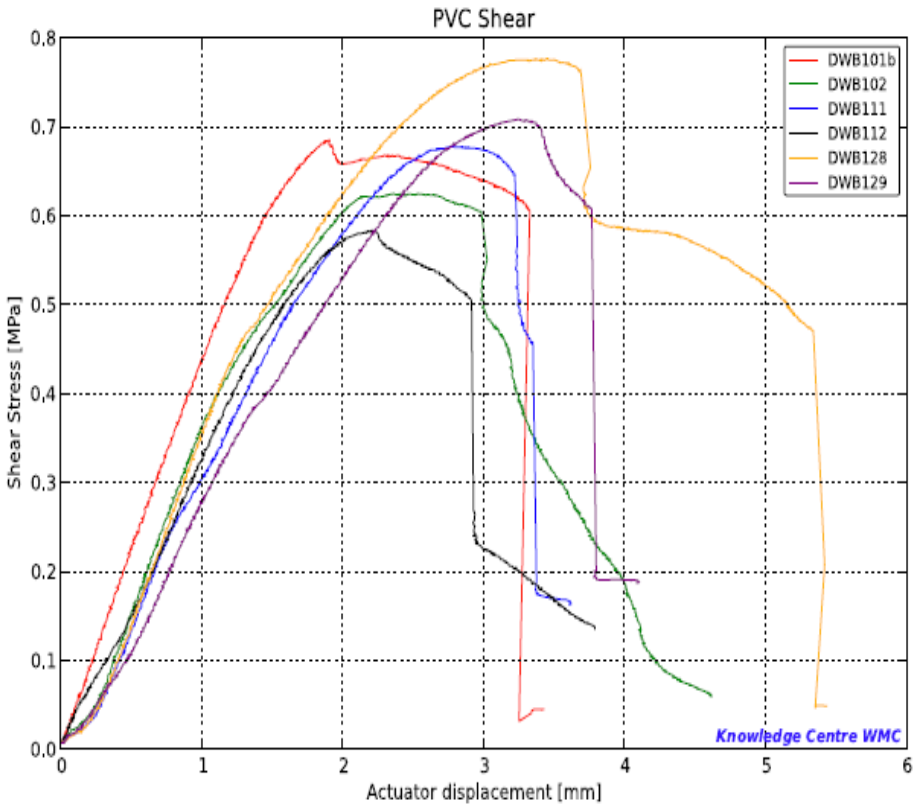
Shear Strength

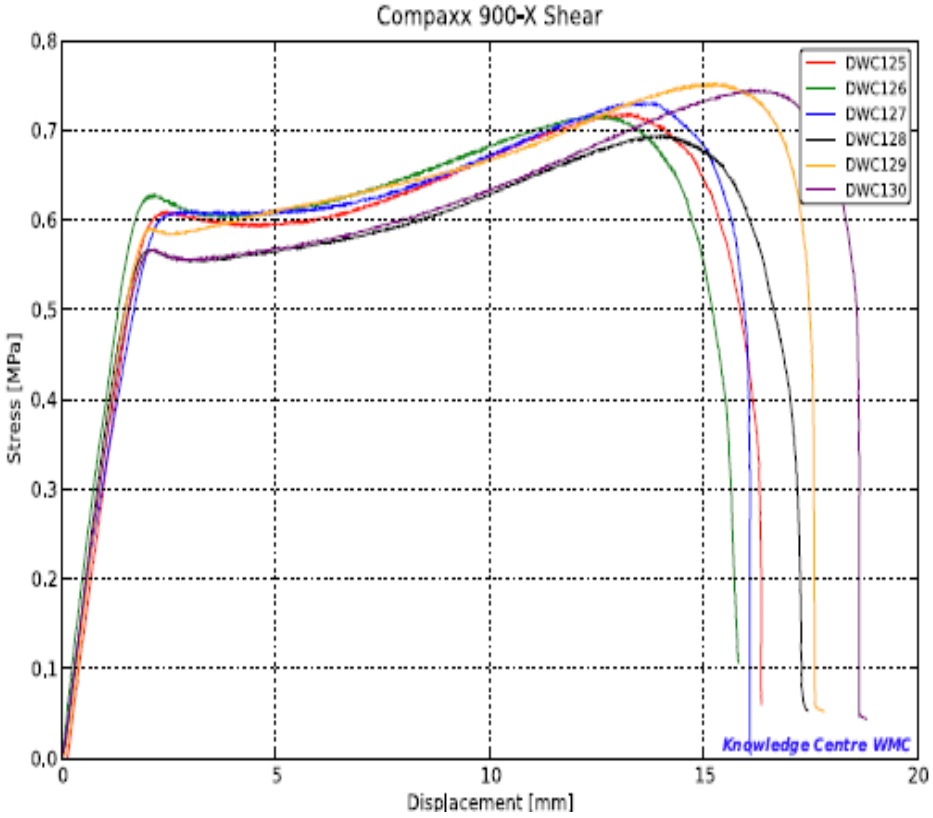


DOW COMPAXX™	PVC 60	PET 100
0.7	0.63	0.69
0.8	0.76	0.85
60 kg/m^3	60 kg/m^3	110 kg/m^3

(1) ISO 1922
(2) Germanischer Lloyd certificate

Comparative shear performance

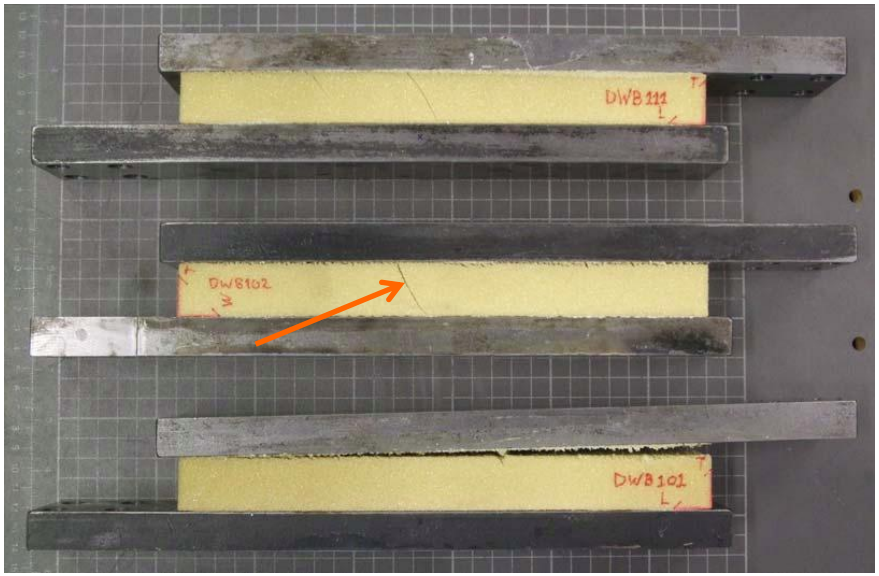


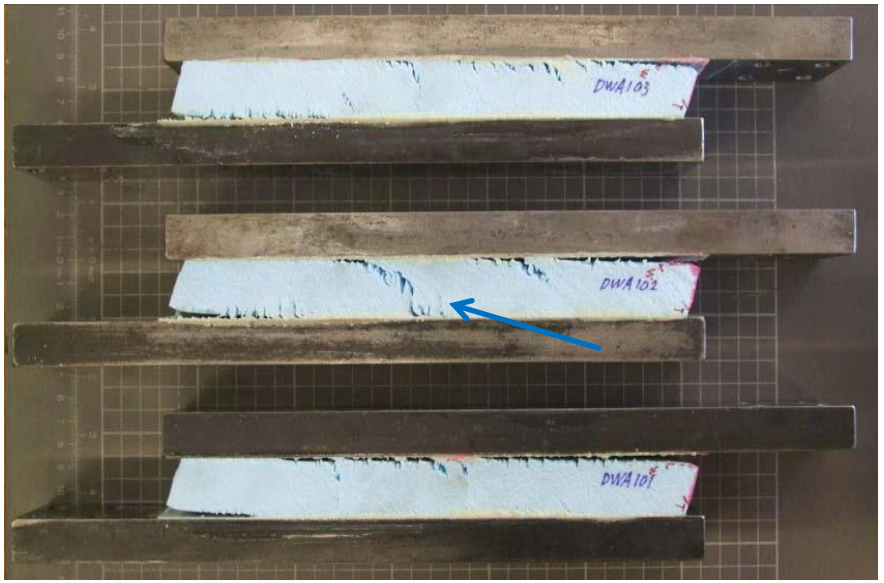


Break occurs shortly after yield
Significant variability between samples

Extended plastic zone
Very consistent response

Comparative shear performance





PVC 60 kg/m^3

Fragile behaviour

10% deformation at break

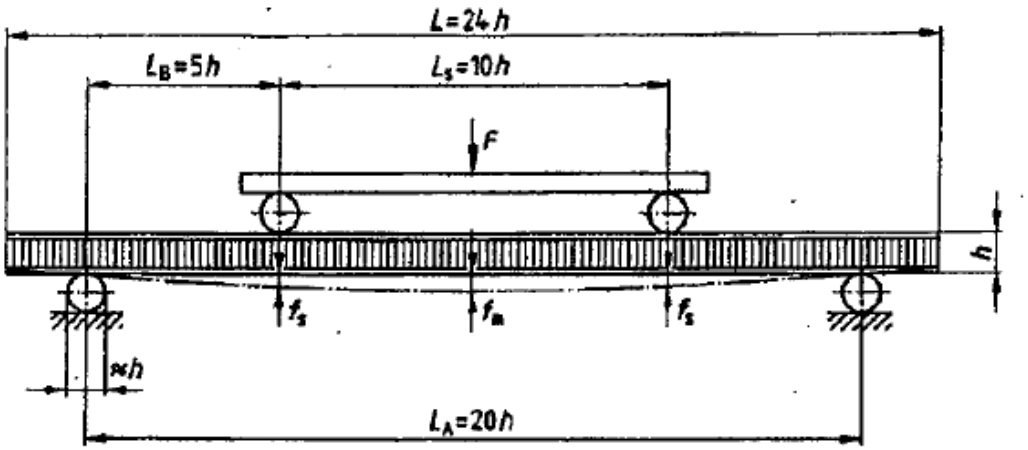
DOW COMPAXX™ 900

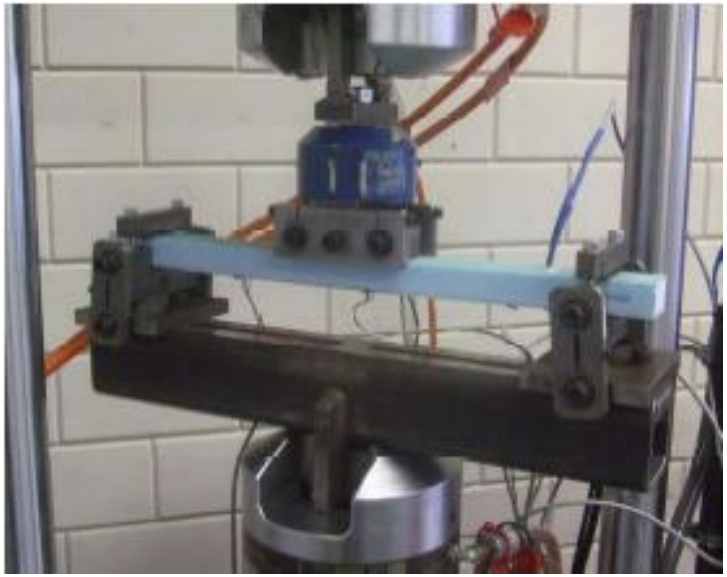
Ductile behaviour

70% deformation at break

Sandwich behavior: dynamic load

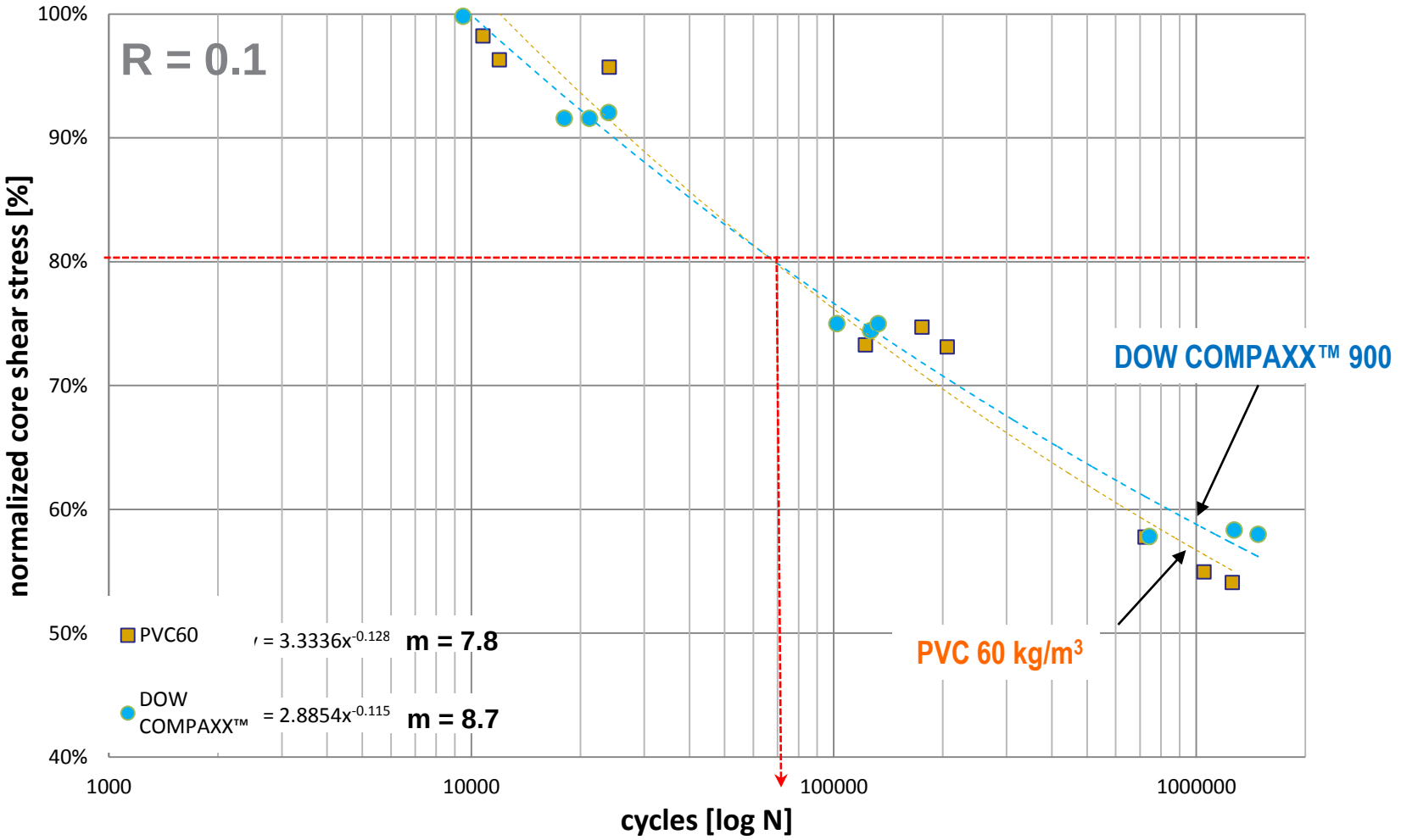
- 4-points flexural bending: (ASTM C393)
  - (As per Germanischer Lloyd recommendation)
- The facings and beam sized to get pure shear stress in the core.
- R = 0.1 – Frequency 1 – 3 HZ





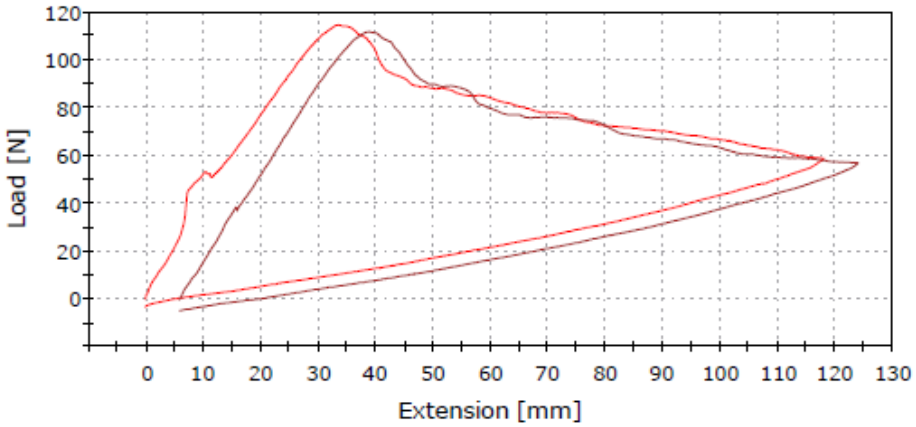
Sandwich behavior: dynamic load

DOW COMPAXX™ 900 vs. PVC 60 kg

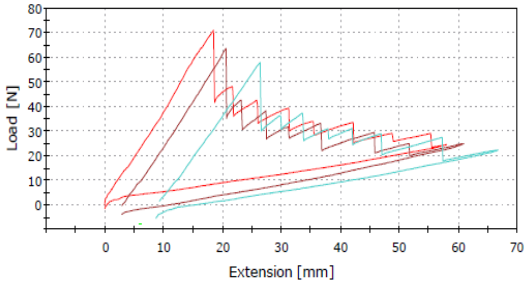


Peel strength and energy comparison

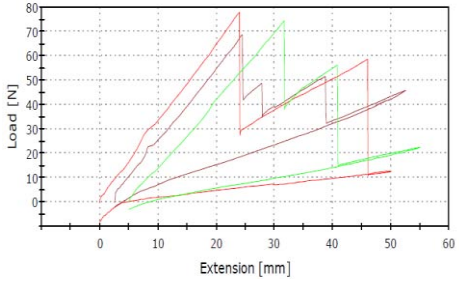
DOW COMPAXX™ 900



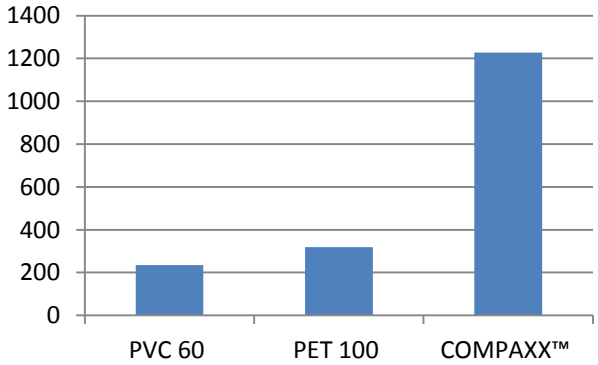
PVC 60 kg/m³



PET 100 kg/m³

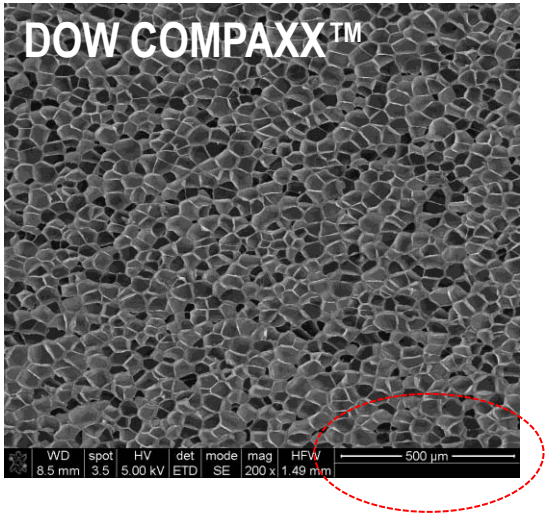


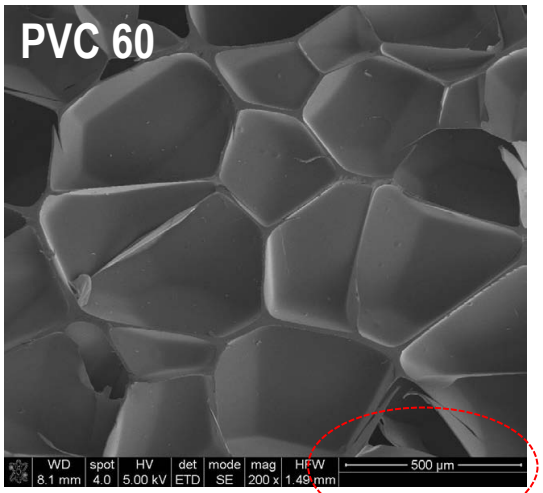
Average Peel Energy (1) J/sqm



(1) ASTM E 2004 – adjusted samples

Best in class for resin pick-up





Consistent small & closed cell structure

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Smooth and homogeneous cut surface

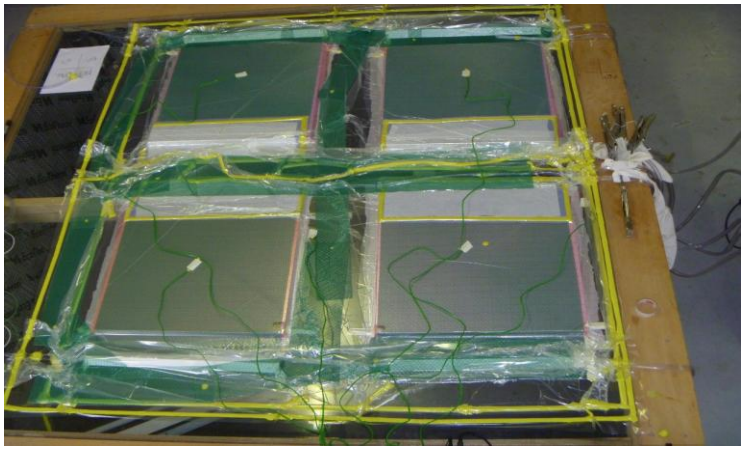
↓

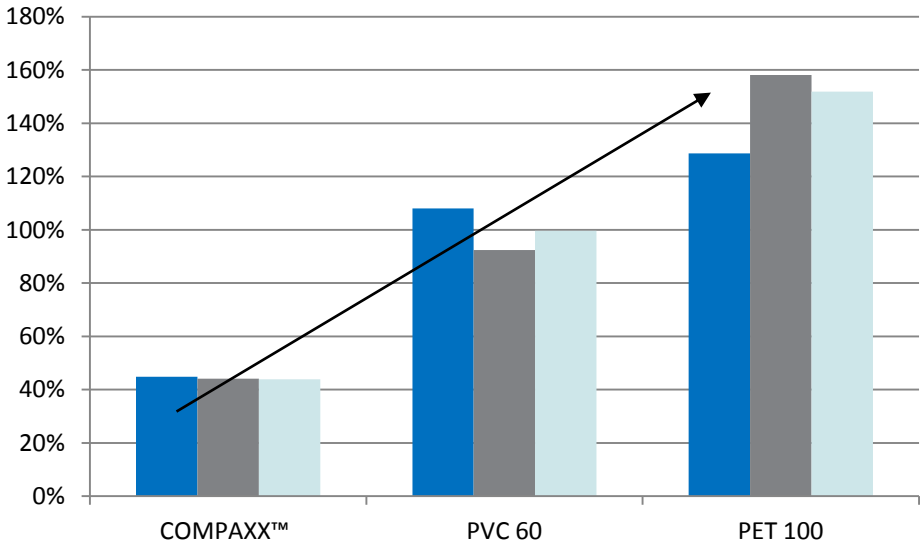
Lowest resin pick up

↓

DOW COMPAXX™

Resin up-take comparison





DOW COMPAXX™ : 250 g/m²
PVC 60 kg/m³ : 550 g/m²

X

Developed surface:
Shear web: 2.65 m² per m²
Shell : 3.75 m² per m²

=

Additional weight per blade:
Shear web: 80 kg
Shell : 150 kg

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230 kg

Typical dimensions for 2 MW blade

Summary – DOW COMPAXX™ 900

- A recyclable foam
- It matches or exceeds the performances of the industry reference foam cores
- A cost effective solution for wind blades
- Germanischer Lloyd Certified

Thank you!

Wind Energy
Solutions
You Can Trust

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