Calcined Neuburg Siliceous Earth in polyketone (PK, aliphatic)

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Status Quo

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- Polyketone is a versatile high-performance polymer for technical components with high mechanical, chemical and tribological requirements, being commercially available again since 2014.
- Besides excellent wear and chemical resistance it shows good mechanical properties and a low water absorption.
- Glass beads are often used to customize properties.
- Mineral filled compounds have been hardly available due to amplification of the polymer inherent viscosity increase issues during processing and so on.

Objective

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Assessment of the performance of

Calcined Neuburg Siliceous Earth

regarding

- » Flow, viscosity stability
- » Mechanical properties
  - – Tensile test
  - – Flexural test
  - – Impact strength
- » Color of compounds

Calcined Neuburg Siliceous Earth

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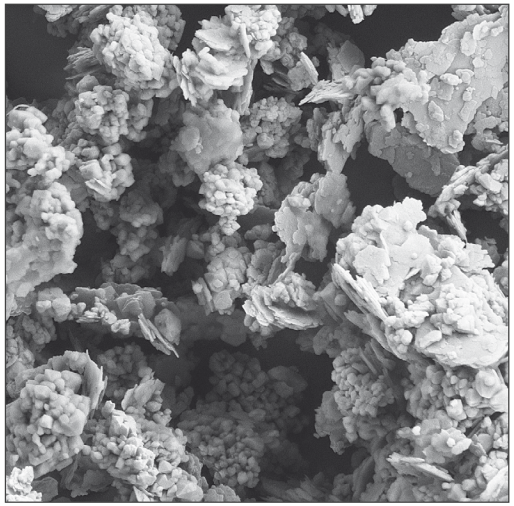
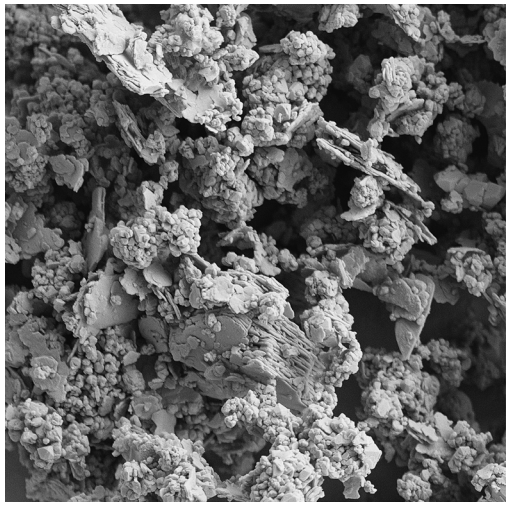
A downstream thermal process leads to the calcined products Silfit and Aktifit, based on SILLITIN Z 86.



Neuburg Siliceous Earth

Calcination Process



Calcined Neuburg Siliceous Earth

Additional application benefits, as well as the removing of crystal water included in the kaolinite. The silica part remains inert.

Fillers and Characteristics

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Filler	Description	Functionali-zation
Aktifit AM	Calcined Neuburg Siliceous Earth d_{50}: 2 µm, d_{97}: 10 µm	Amino
Aktifit PF 115	Calcined Neuburg Siliceous Earth d_{50}: 2 µm, d_{97}: 10 µm	Amino

Compounding
Injection Molding

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Composition	70 % Polyketone M330A, Hyosung 30 % Filler
Compounding	Twin screw extruder ZSK 30
Injection molding of test specimens acc. to ISO 1874	Mold acc. to ISO 294 Mold temperature: 80 °C Melt temperature: 245 °C

Melt Volume-flow Rate

DIN ISO 1133; 240 °C, 2.16 kg

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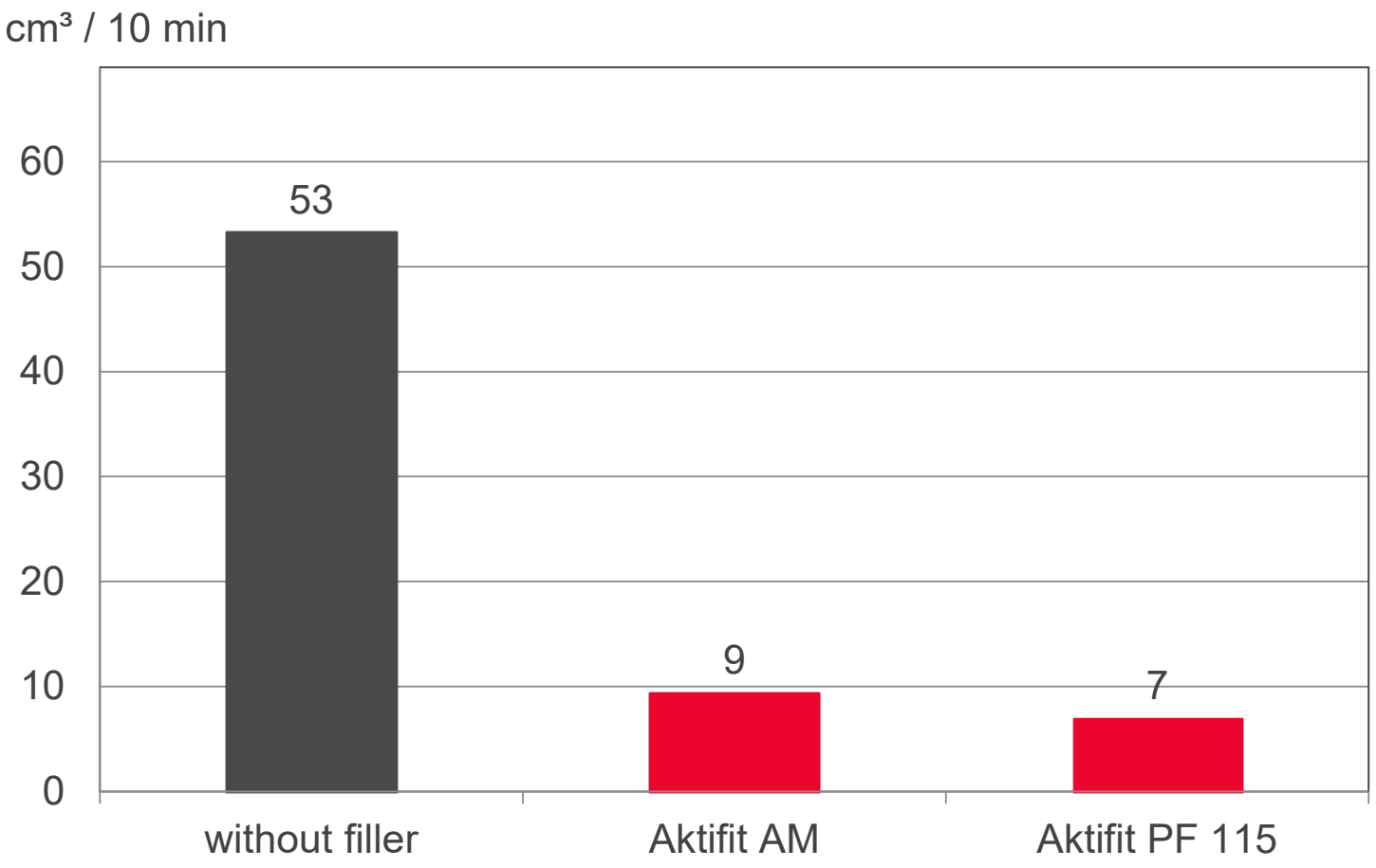

Flow Spiral

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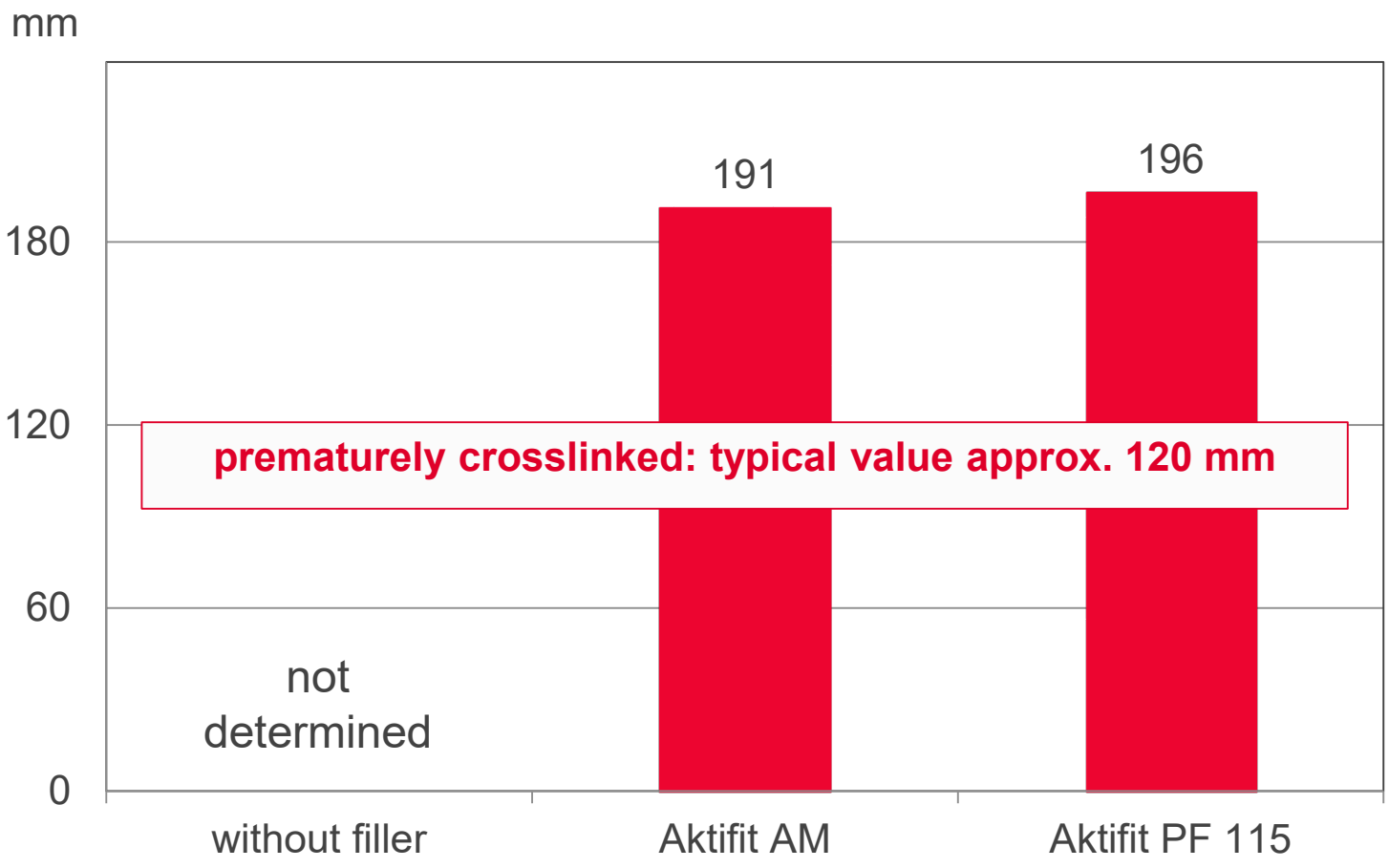

Tensile Modulus

DIN EN ISO 527-1,-2; 1 mm/min

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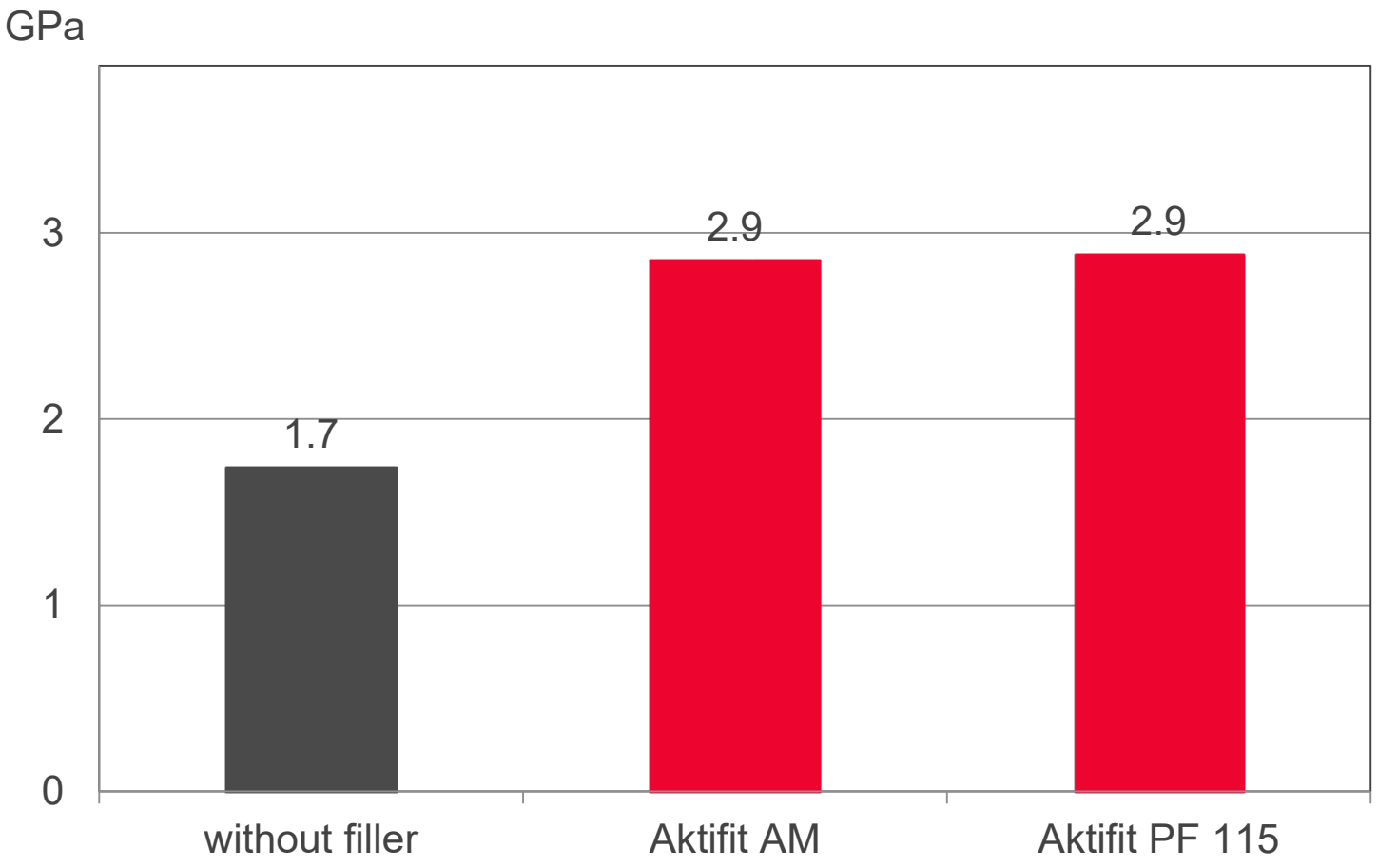

Tensile Yield Stress

DIN EN ISO 527-1,-2; 50 mm/min

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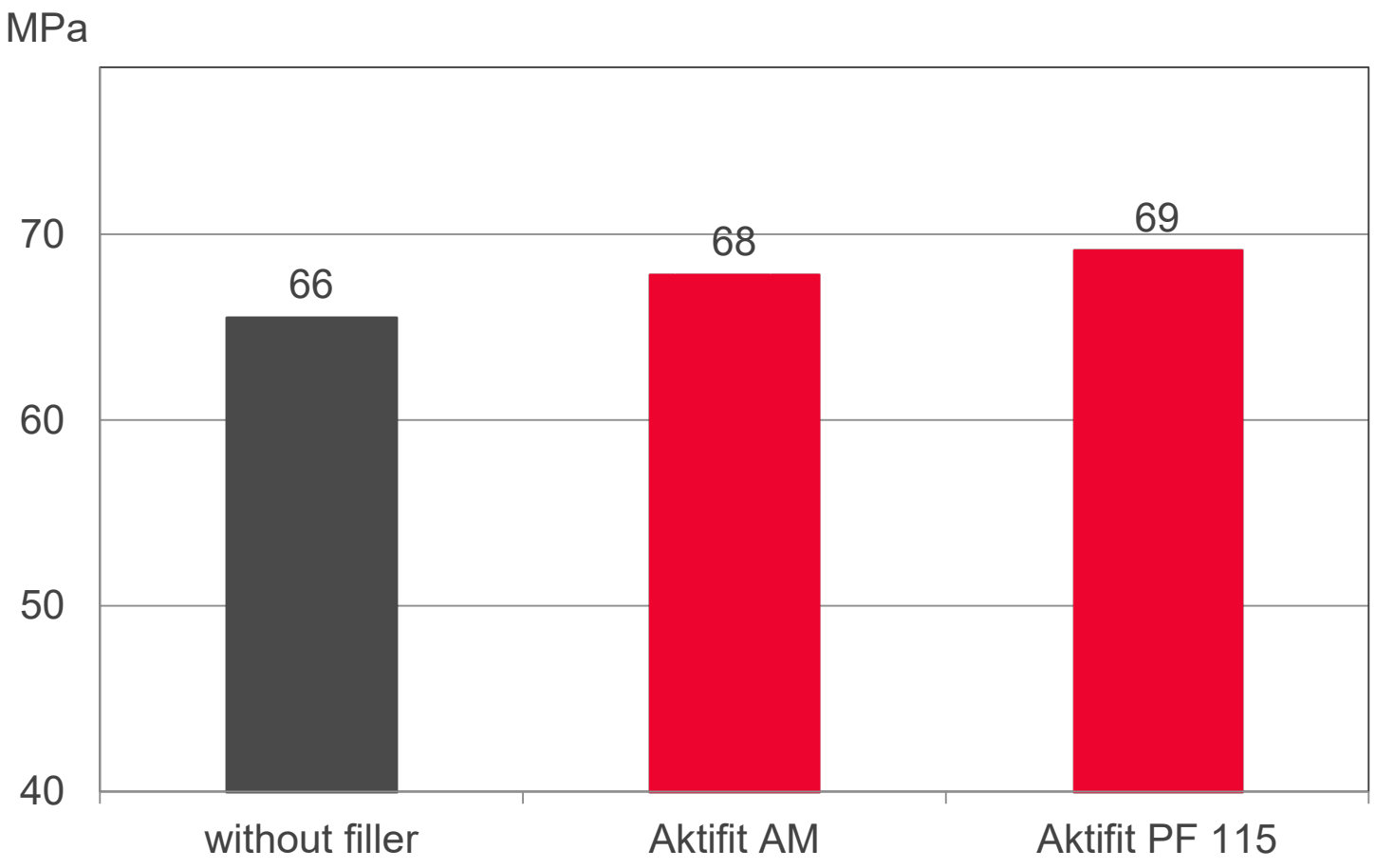

Tensile Yield Strain

DIN EN ISO 527-1,-2; 50 mm/min

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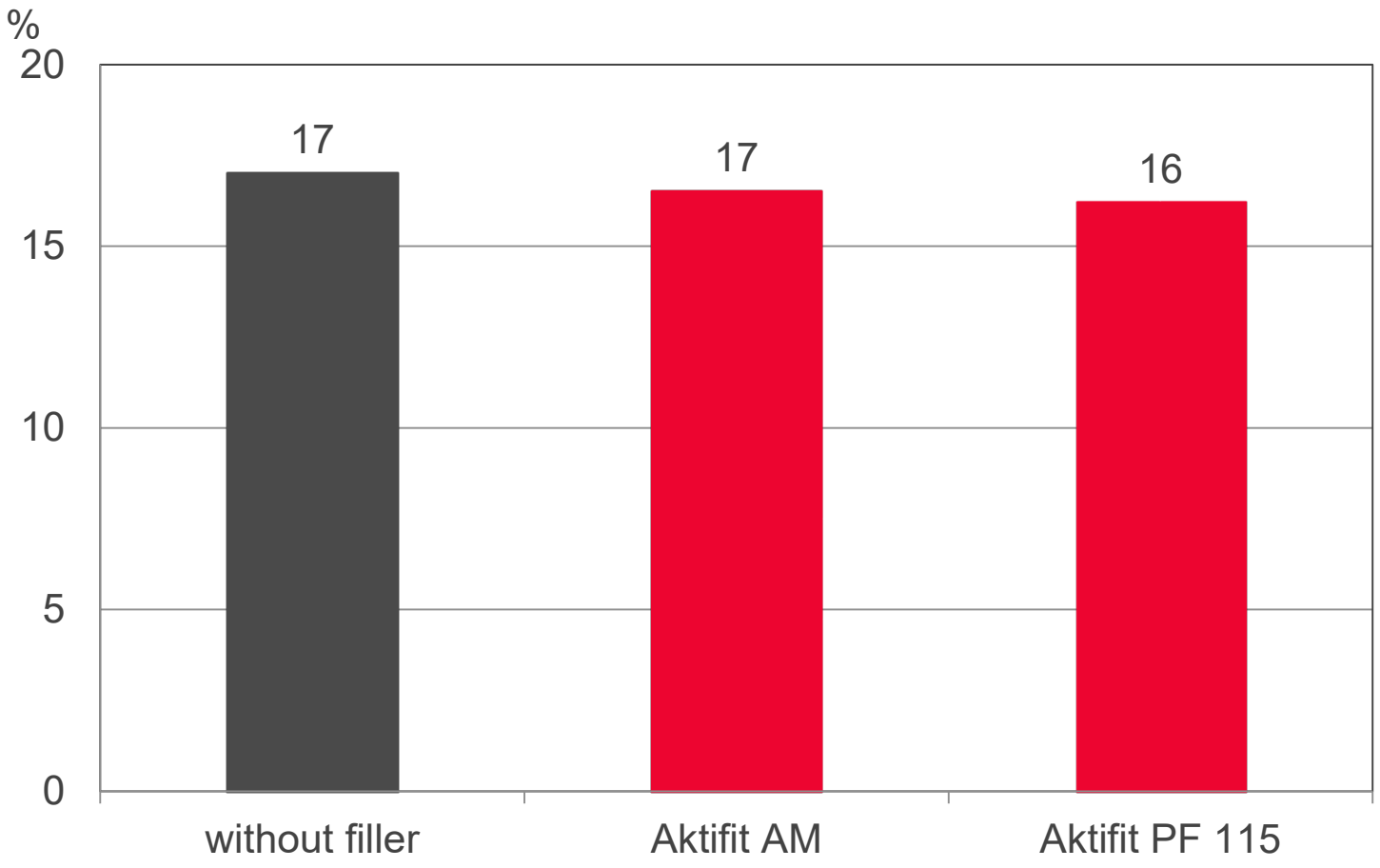

Flexural Modulus

DIN EN ISO 178

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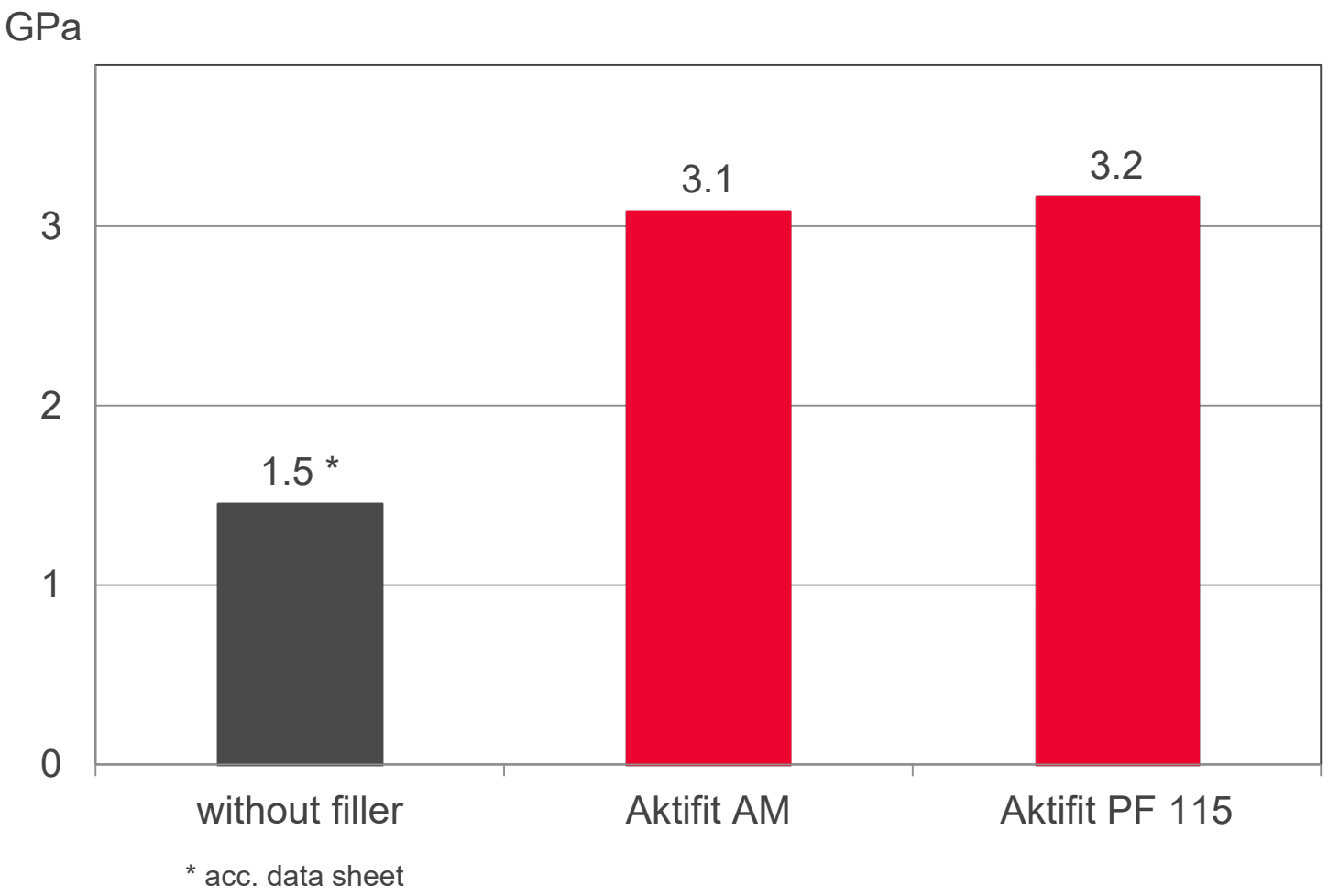

* acc. data sheet

Flexural Strength

DIN EN ISO 178

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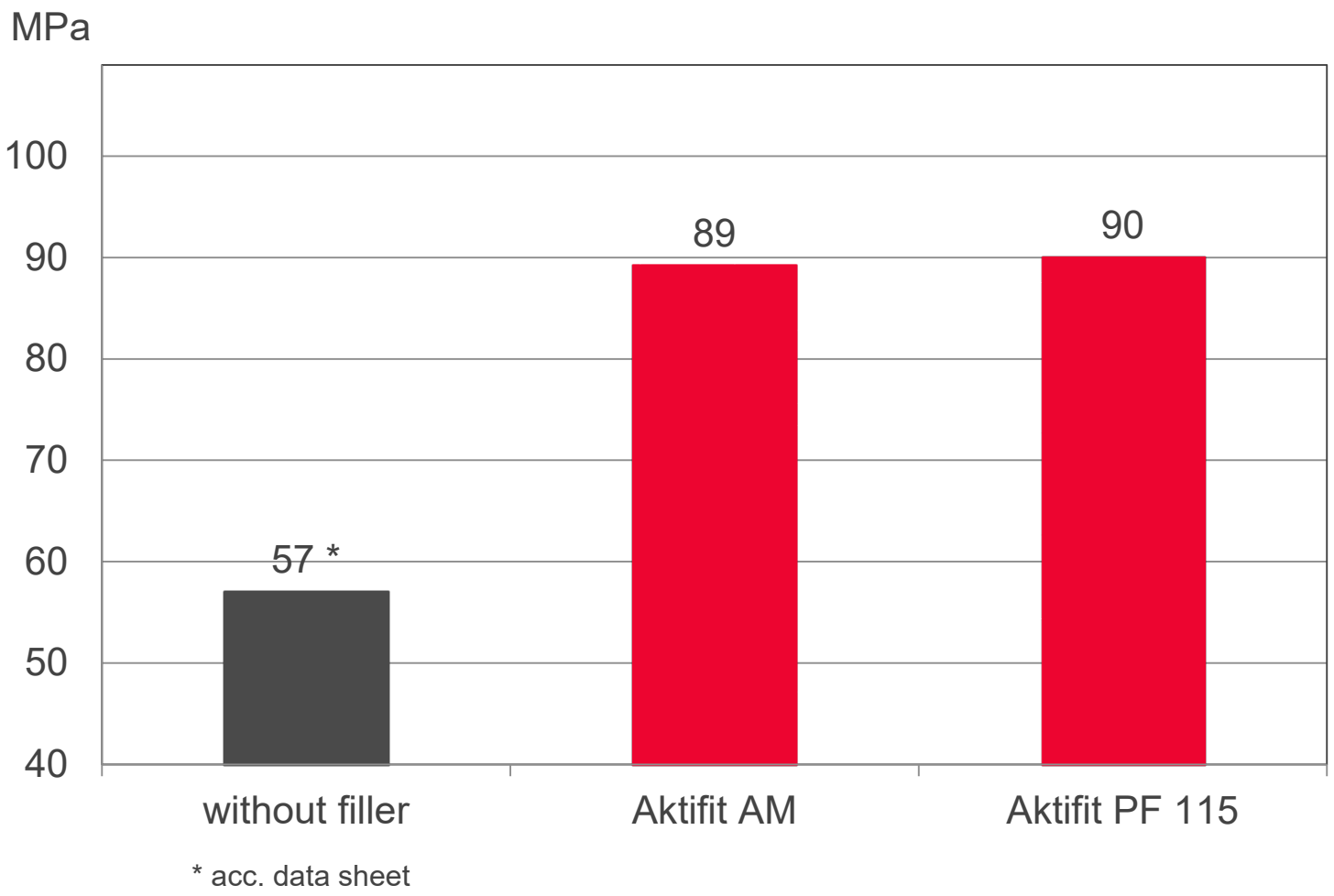

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Charpy
Notched Impact Strength, 23 °C

DIN EN ISO 179-1/1eA

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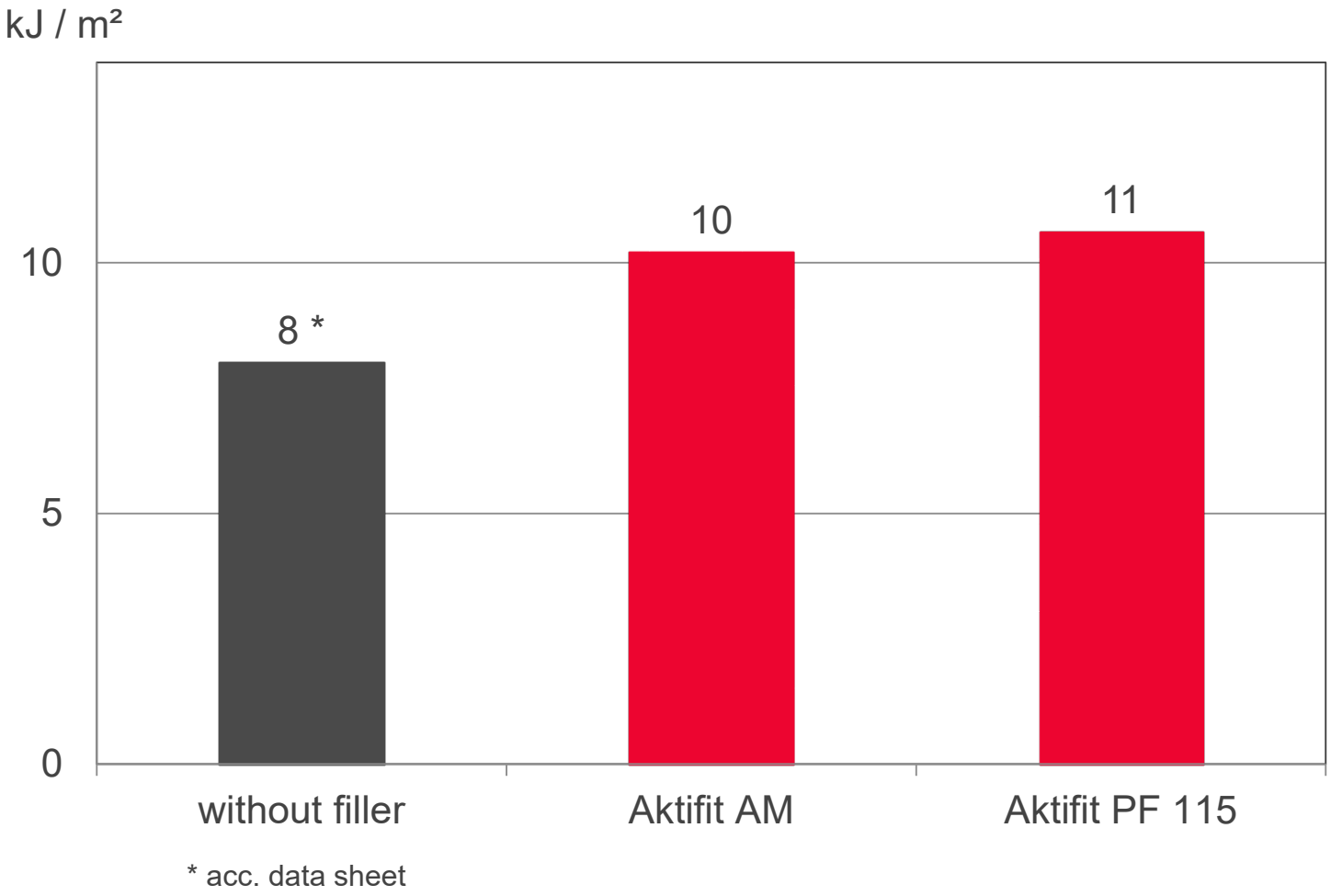

* acc. data sheet

Charpy
Notched Impact Strength, -30 °C

DIN EN ISO 179-1/1eA

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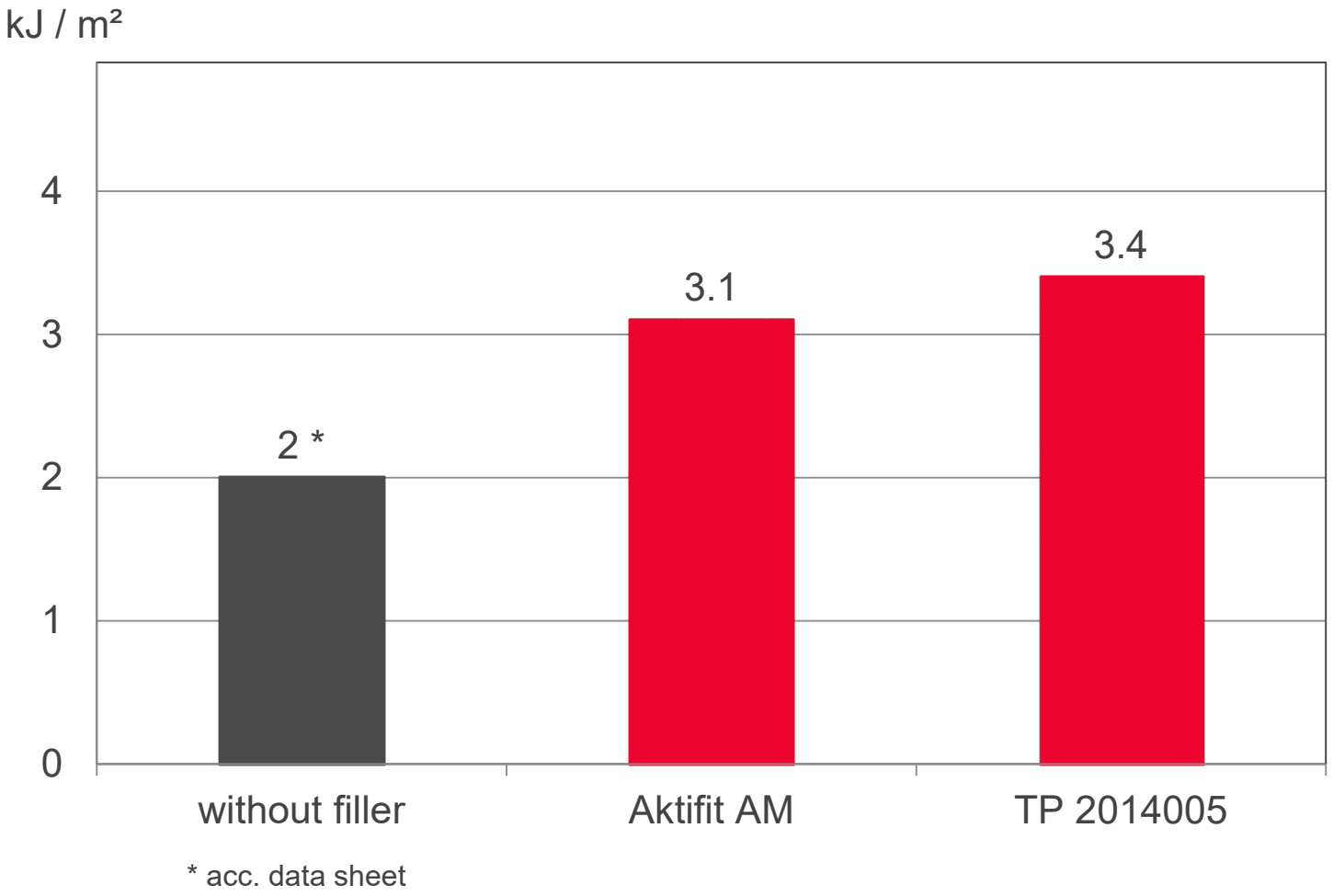

* acc. data sheet

Charpy
Impact Strength, 23 °C

DIN EN ISO 179-1/1eU

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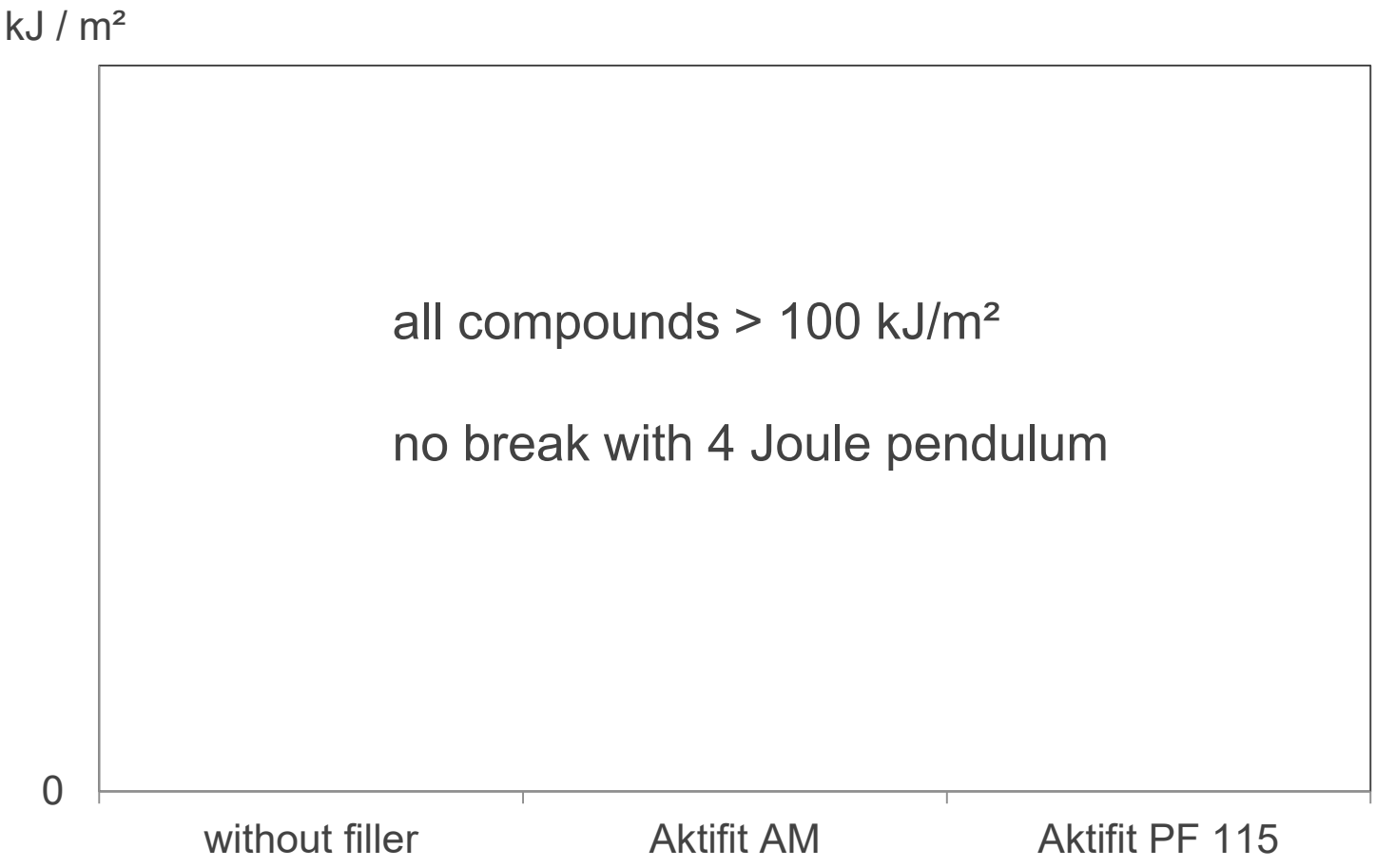

Charpy
Impact Strength, -30 °C

DIN EN ISO 179-1/1eU

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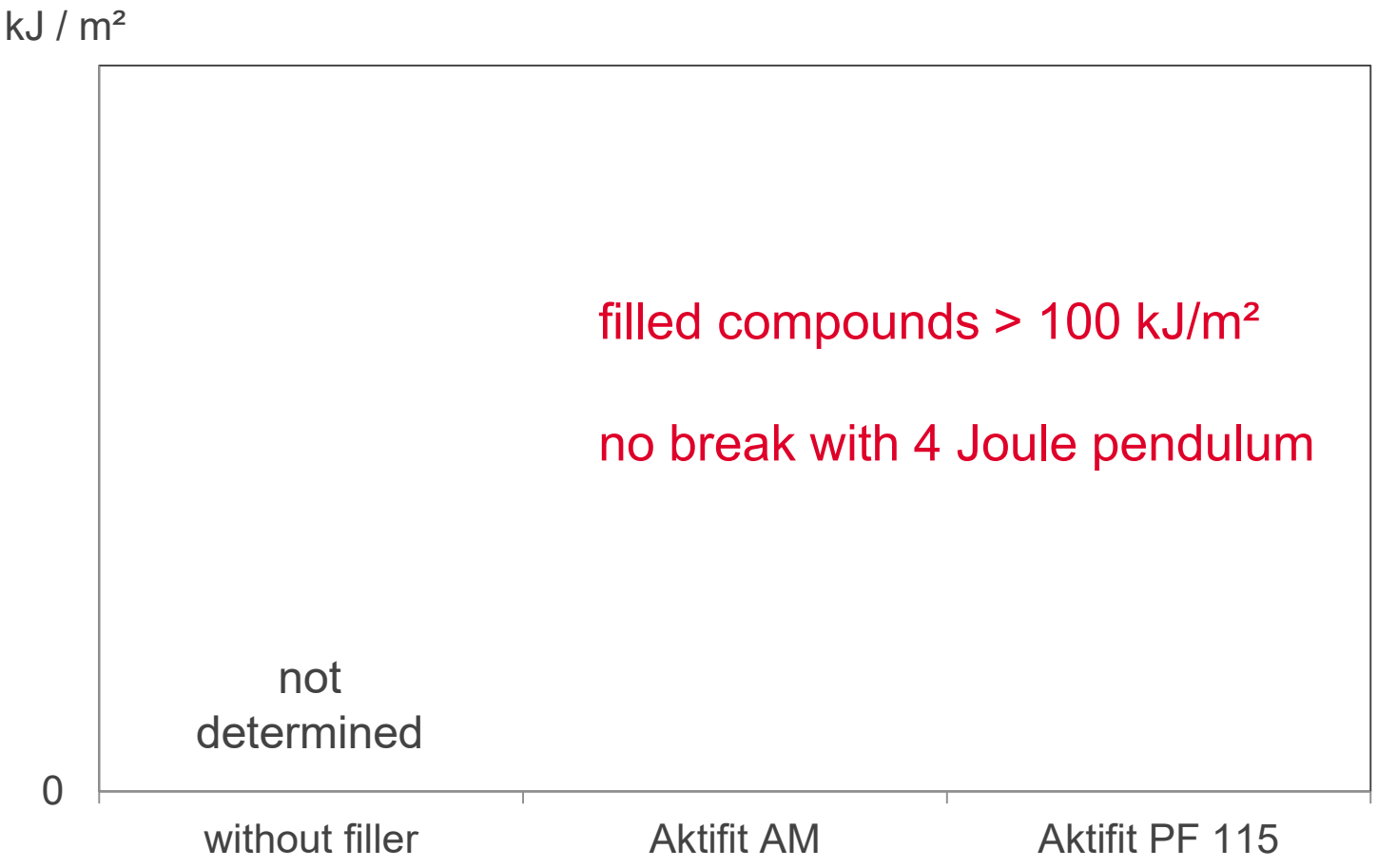

Color of Specimens

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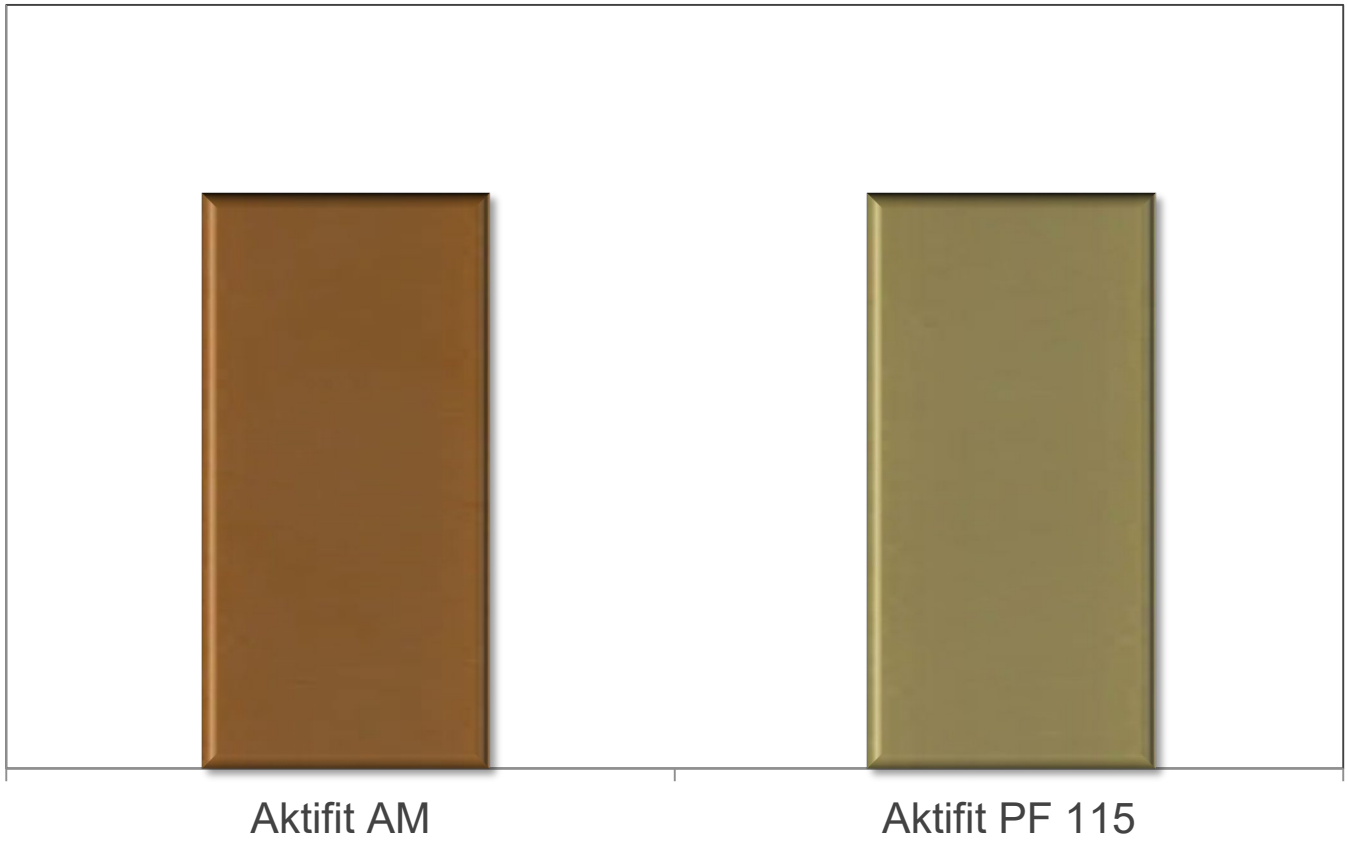

Summary

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Aktifit AM and Aktifit PF 115 are attractive mineral fillers for polyketone, because they do not cause premature crosslinking during processing.

Properties vs. the unfilled polymer:

- lower melt flow rate
- higher stiffness
- slightly higher tensile yield stress at comparable tensile yield strain
- markedly higher flexural strength
- similar or slightly higher notched impact strength
- good unnotched impact strength: no break with 4 J pendulum, even at low-temperature
- Aktifit PF 115 leads to brighter, more color neutral compounds

Conclusion

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Aktifit AM and Aktifit PF 115 are the best choice for polyketone compounds with focus on

- melt stability
- flowability
- deformability
- impact strength, ambient and low temperature

at a higher stiffness and strength level than the neat polymer.

Not included in this presentation, however additional effects will be expected:

- scratch and abrasion resistance
- chemical resistance
- barrier properties

We supply material for good ideas!

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			M330A unfilled	Aktifit AM	Aktifit PF 115
Melt Volume-flow Rate		cm³/10 min	53.2	9.3	6.9
Tensile Modulus		GPa	1.74	2.85	2.88
Tensile Yield Stress		MPa	65.5	67.8	69.1
Tensile Yield Strain		%	17.0	16.5	16.2
Nominal Strain at Break		%	224	21	16
Flexural Modulus		GPa	1.45 *	3.08	3.16
Flexural Strength		MPa	57 *	89.2	90.0
Impact Strength	23 °C	kJ/m²	No break	No break	No break
Charpy, 1eU	-30 °C	kJ/m²	-	No break	No break
Notched Impact Strength	23 °C	kJ/m²	8 *	10.2	10.6
Charpy, 1eA	-30 °C	kJ/m²	2 *	3.1	3.4

* acc. data sheet