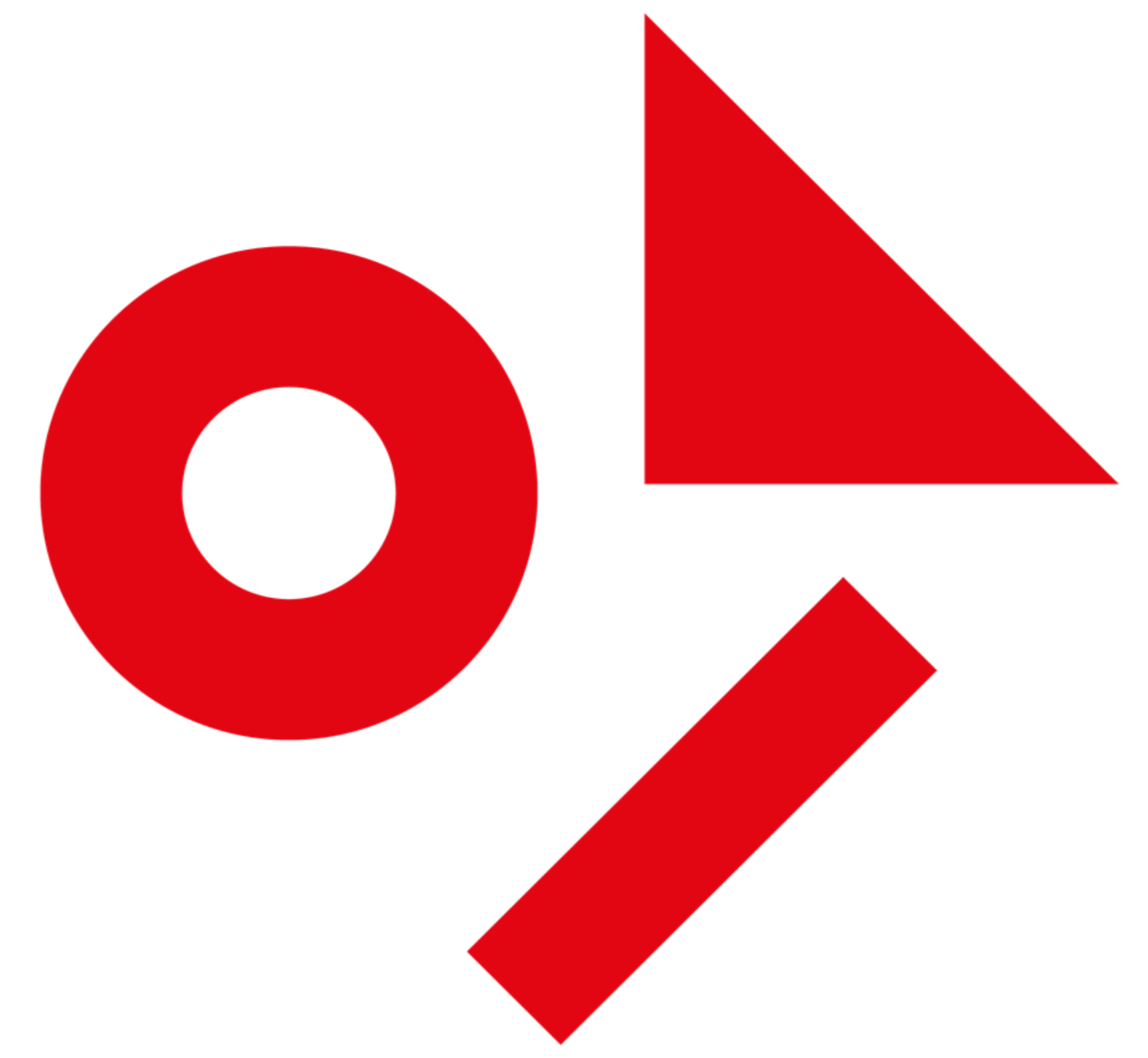


# Thermoplastic compounds



Please select topic for further information

---

Gloxil iM16k A functionalized hollow glass spheres.  
To en-light the future.

---

---

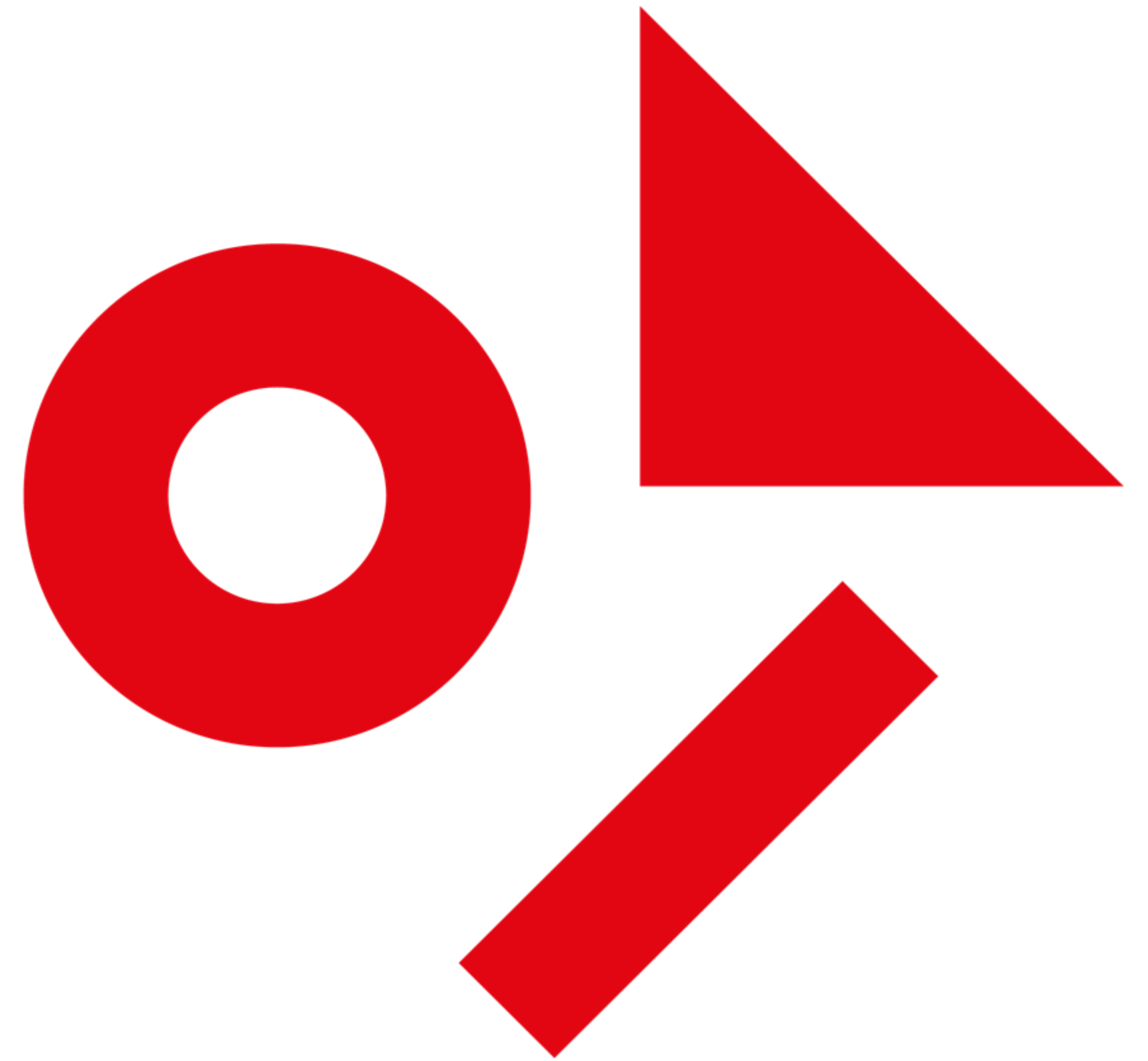
Gloxil iM16k A in Polyamide PA6

---

---

Gloxil iM16k A in Polyamide PA6 GF15

---



---

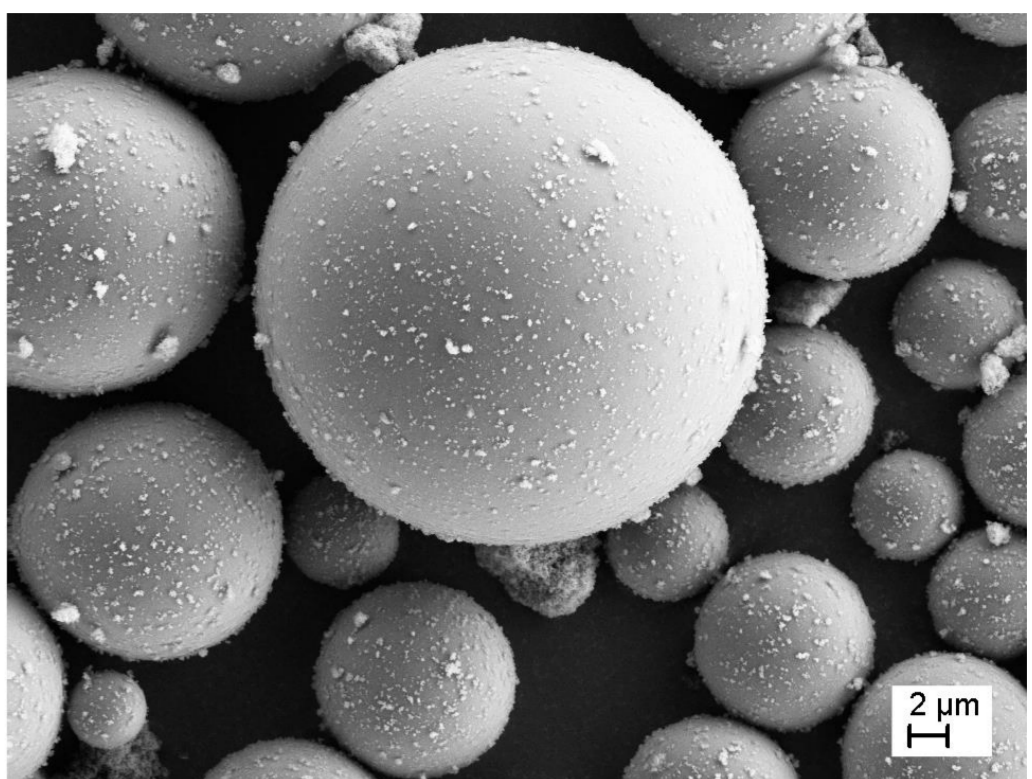
**Gloxil iM16k A functionalized  
hollow glass spheres.  
To en-light the future.**

---

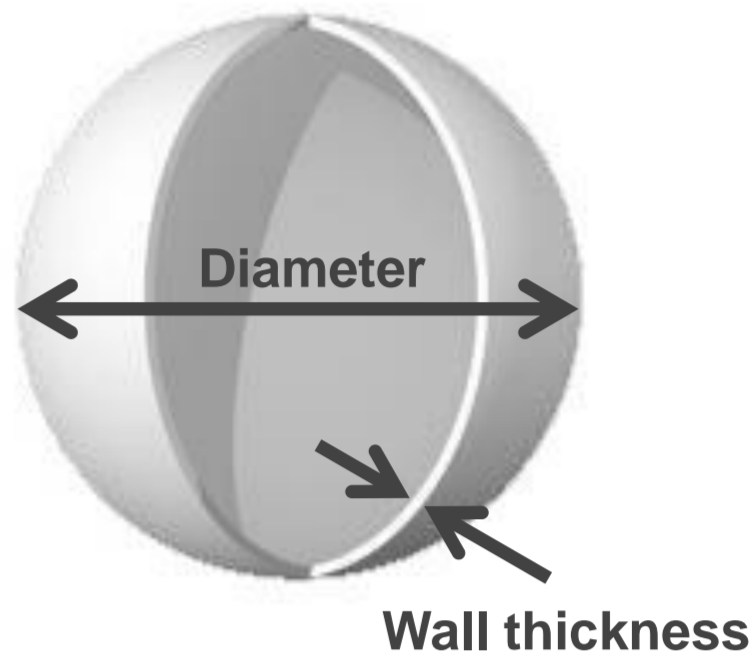


# Base material

3M™ Glass Bubbles iM16k		
Shape		Hollow, thin-walled, single-cellular spheres
Composition		Borosilicate glass, chemical and water resistant
Color		white
Hardness	Mohs Scale	5
Softening temperature	[°C]	600
Density	[g/cm³]	0.46
Average particle diameter	[µm]	20
Isostatic collapse strength	[MPa] [psi]	110 16000
© data and pictures by 3M Advanced Materials Division		



Glass Bubble as manufactured

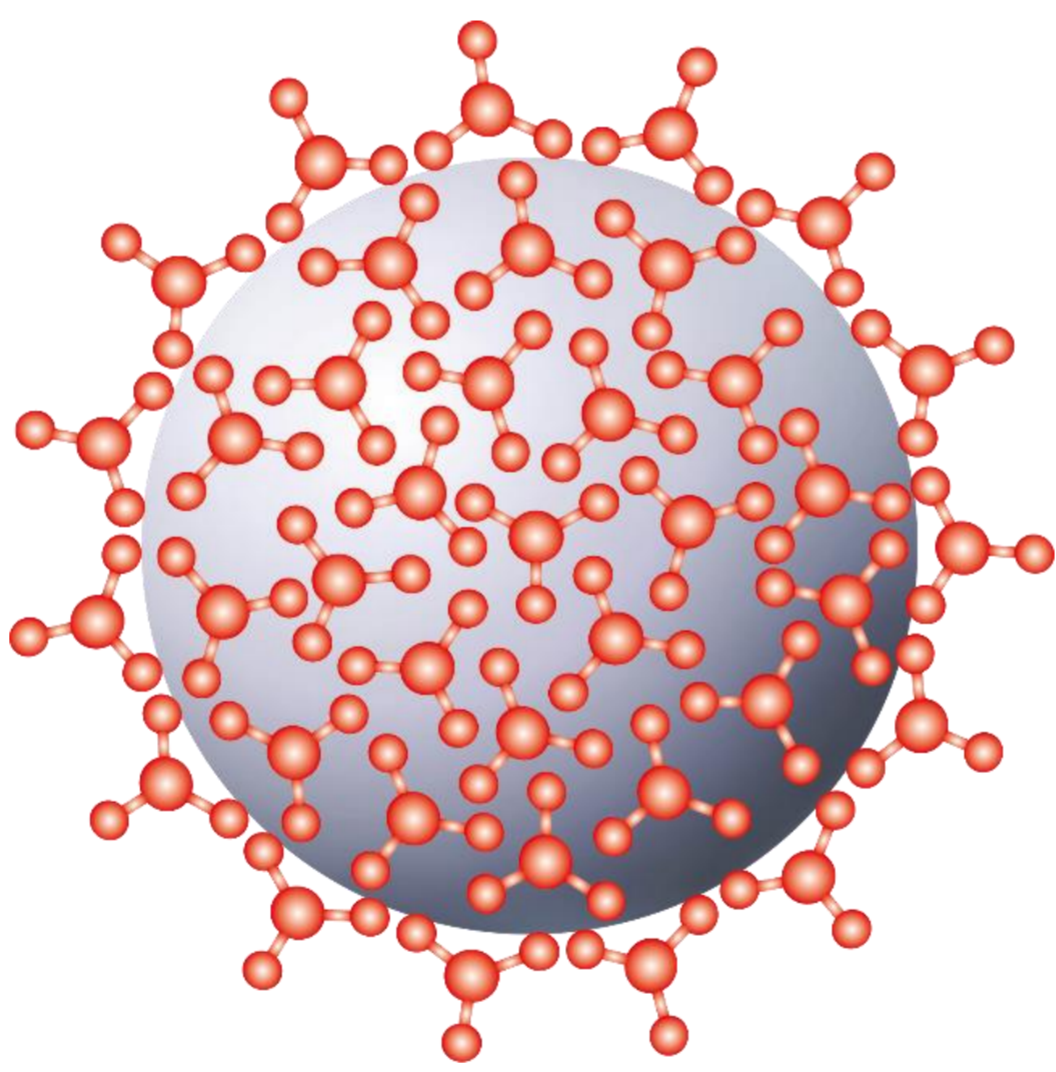
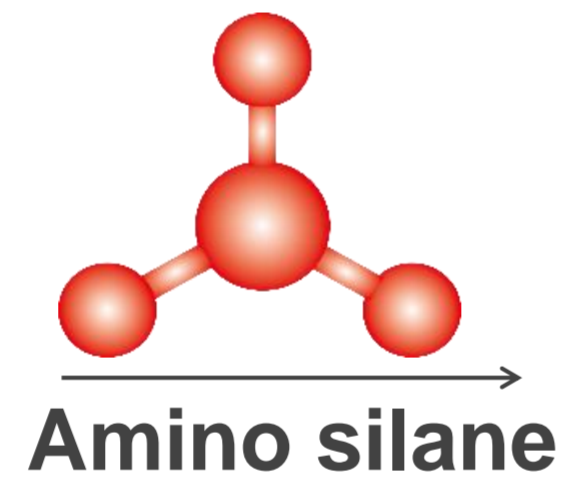


# Functionalization

A special process creates the **GLOXIL iM16k A**



3M™ Glass Bubbles iM16k



**GLOXIL iM16k A**

Characteristics		
Color L* (CIELAB)		98
Density	[g/cm³]	0.46
Bulk density	g/cm³	0.19
Particle size D <sub>50</sub>	[µm]	22
Particle size D <sub>97</sub>	[µm]	45
Specific surface area BET	[m²/g]	2
Air jet screening >125 µm	[%]	0.2
Volatile matter at 105 °C	%	0.3
Flotation rate	[%]	96
pH		10
Functionalization		Amino

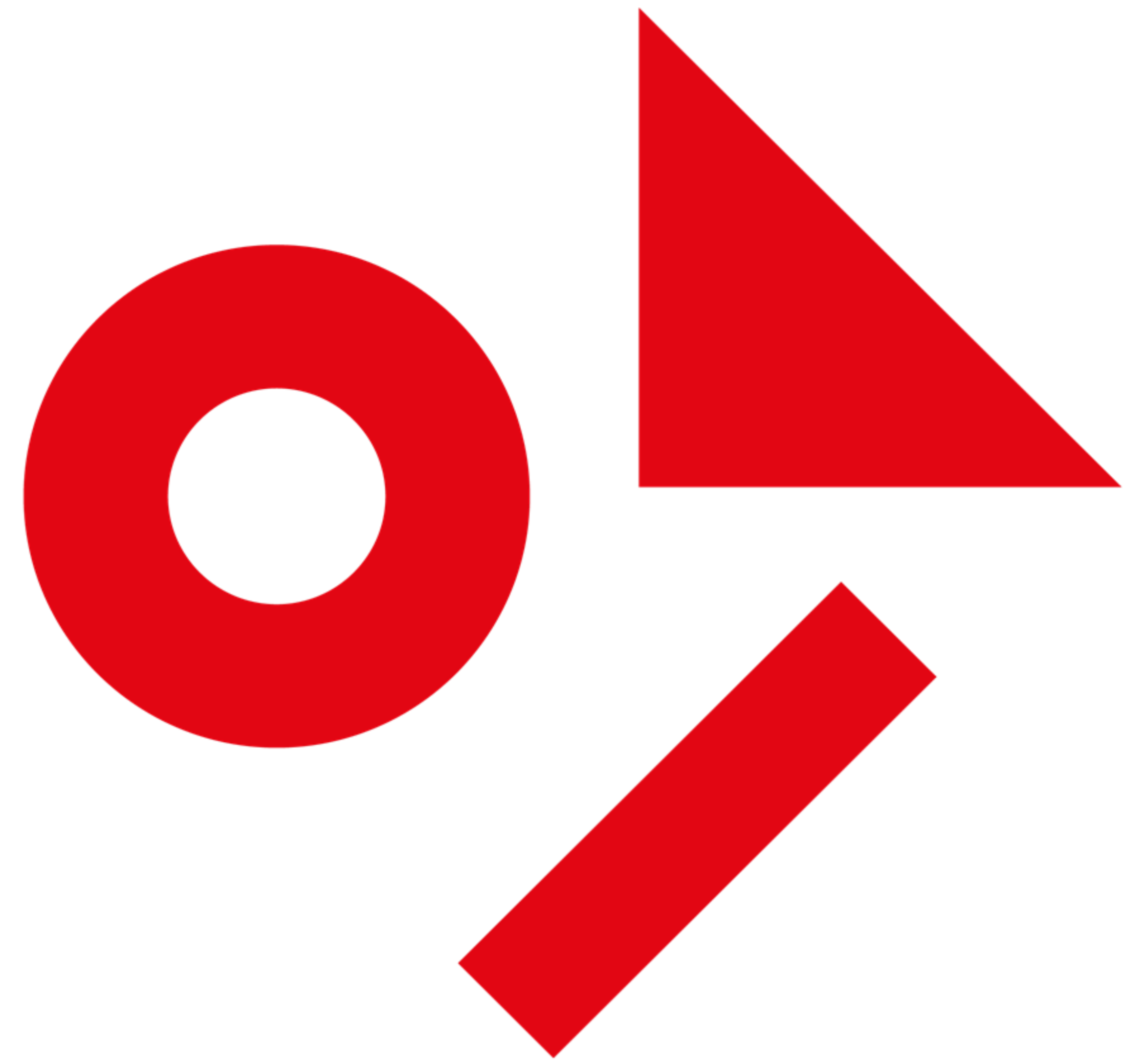
Typical properties, no specification

# Objective

Positive effects with the surface functionalized **GLOXIL iM16k A** on the mechanical property profile of Polyamide and Polypropylene.







---

# Gloxil iM16k A in Polyamide PA6

---

# Results

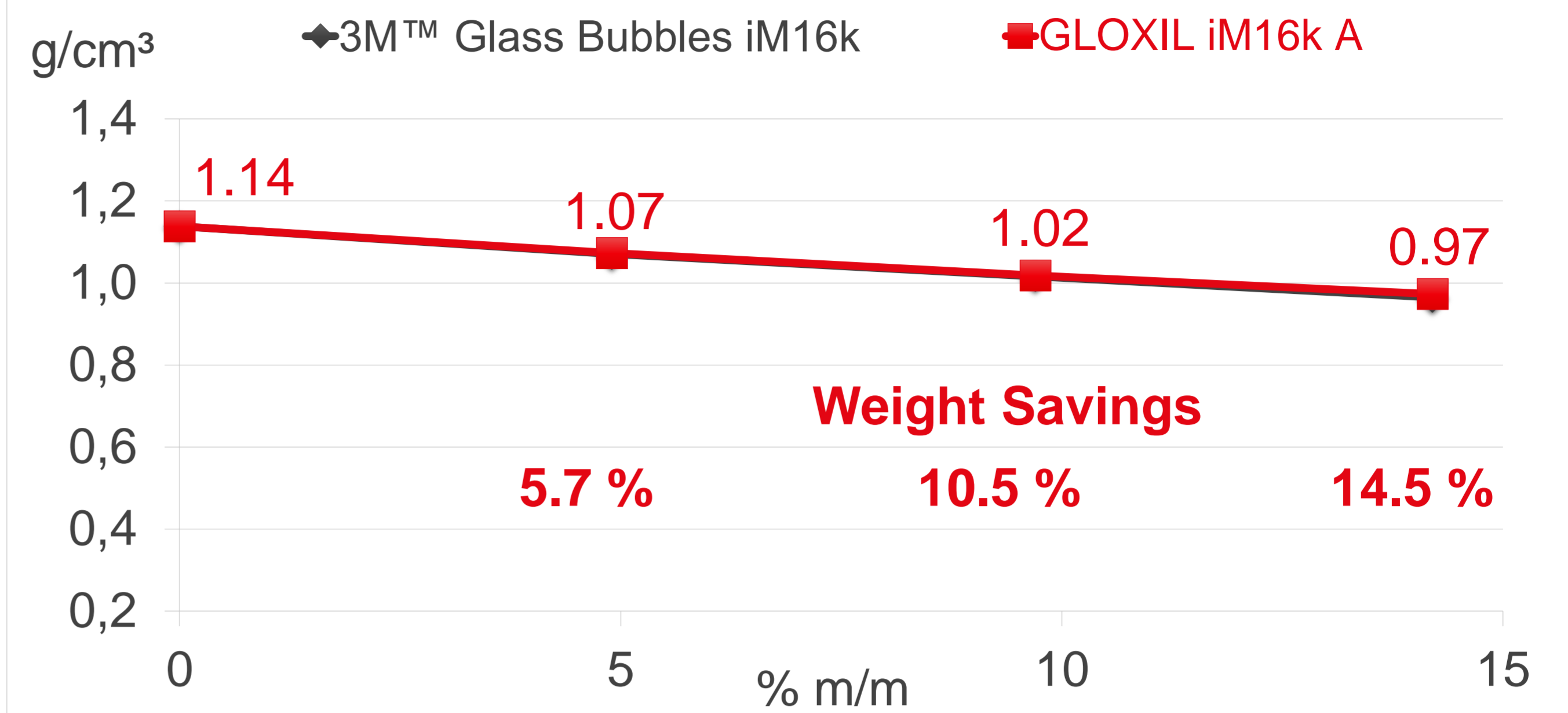
**Objective:**  
Density / weight reduction and still good mechanical properties

PA compound Ultramid® B3K  
BASF  
Melt volume rate MVR 160 cm<sup>3</sup>/10 min (275 °C, 5 kg)

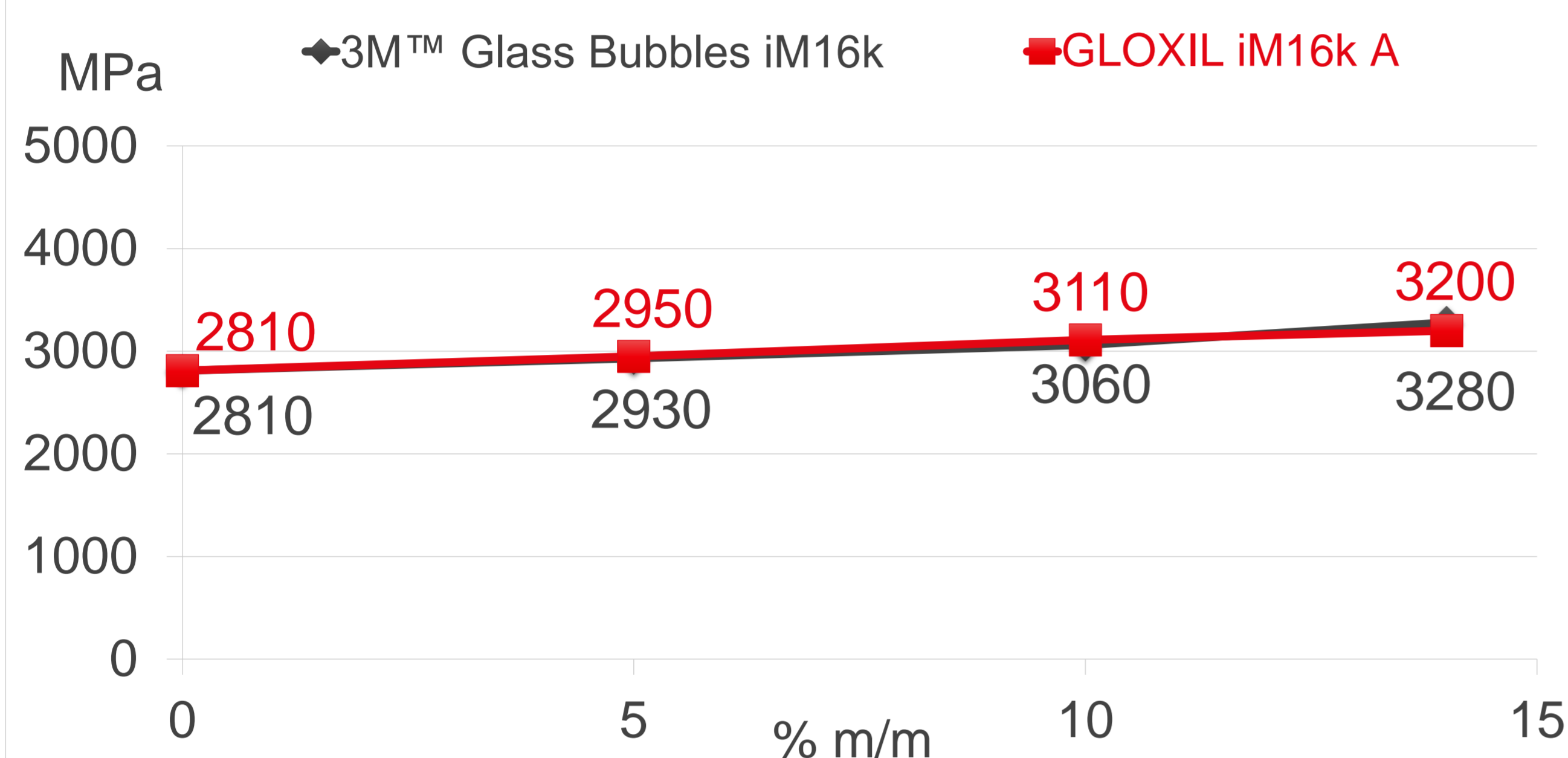
3M™ Glass Bubbles iM16k	0 to 14 % (m/m) 0 to 29 % (v/v)	---
GLOXIL iM16k A	---	0 to 14 % (m/m) 0 to 29 % (v/v)
<b>Total</b>	<b>100</b>	<b>100</b>

Data determined by 3M Advanced Materials Division, Special Additives Laboratory

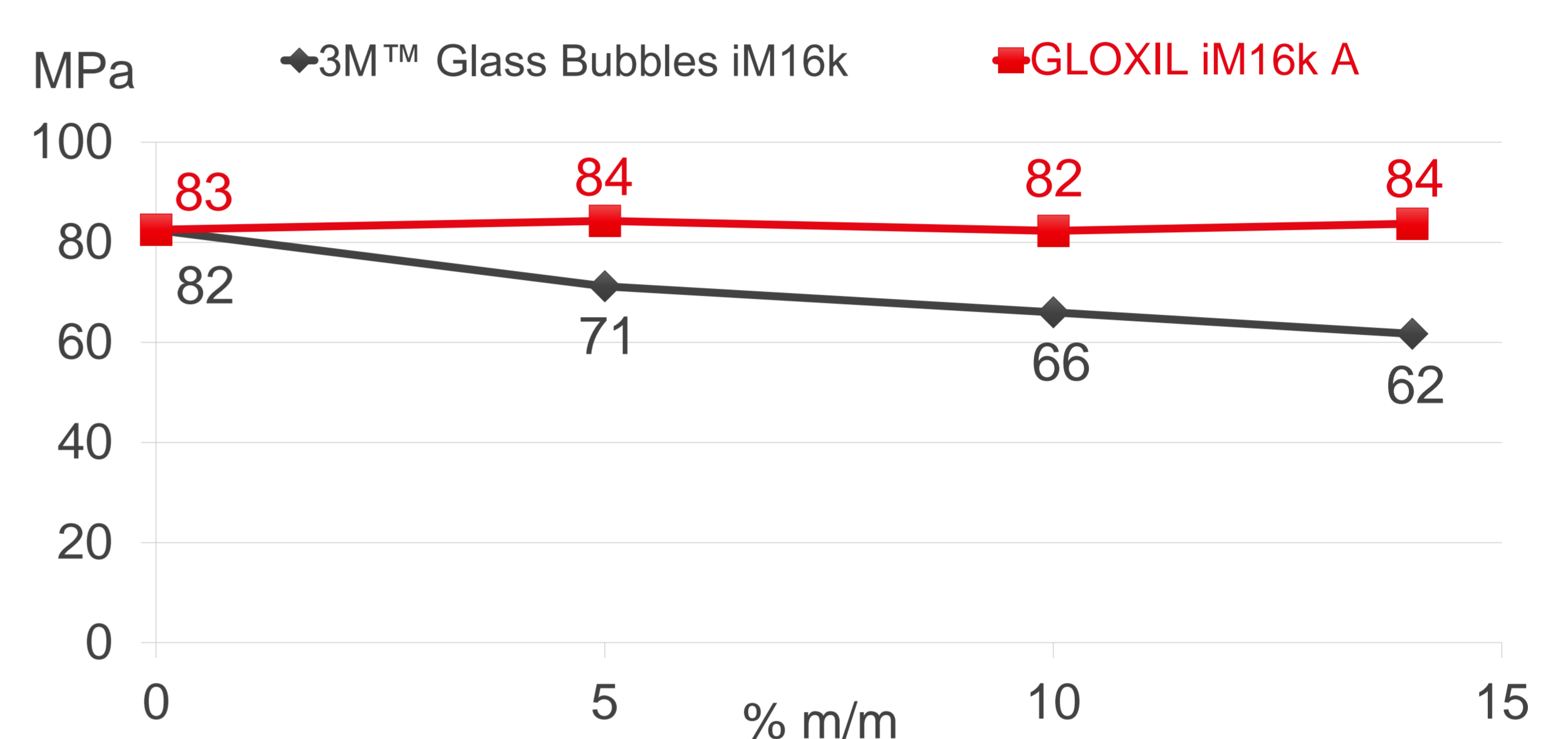
## Density and weight reduction (measured)



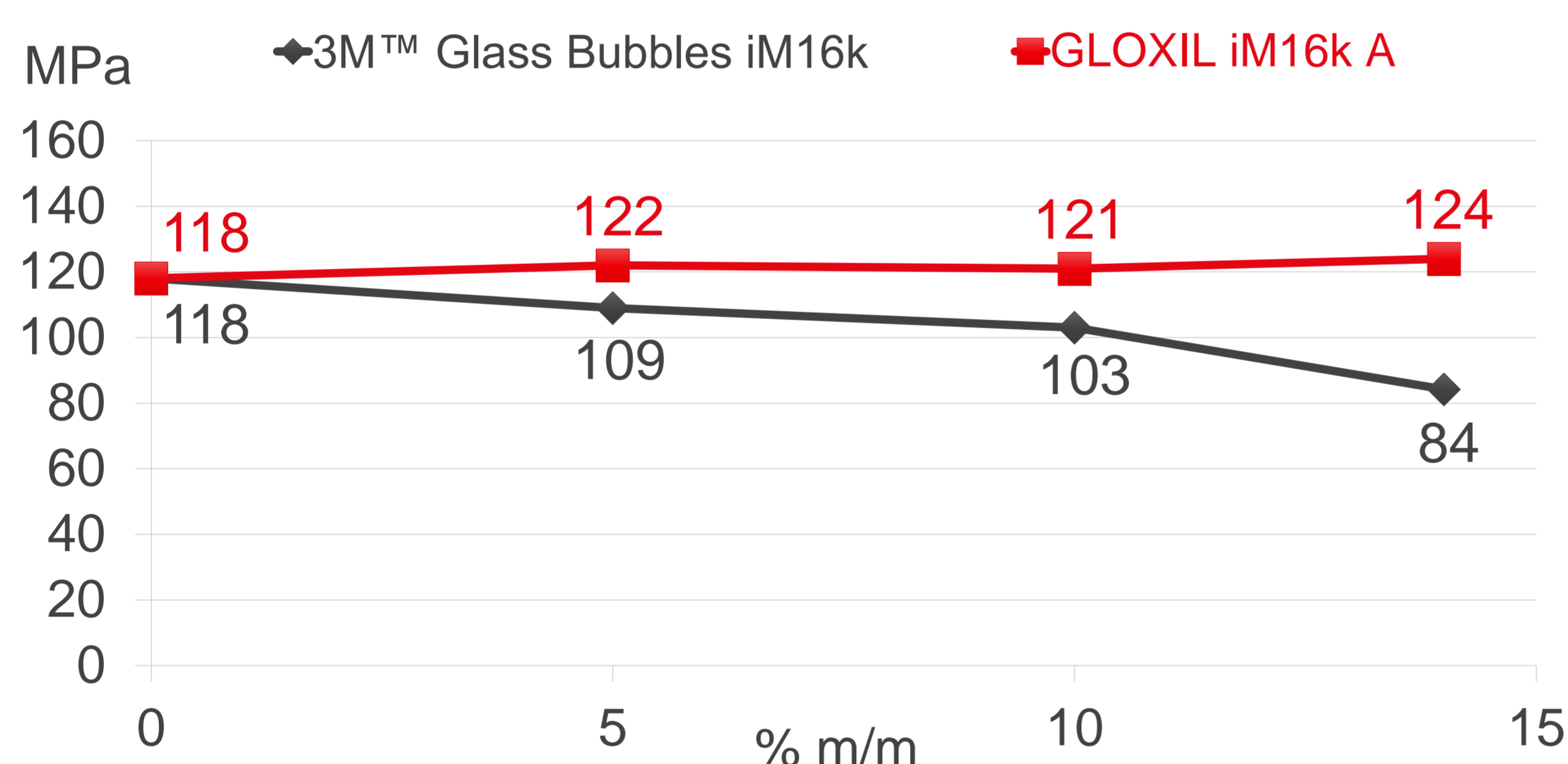
## Flexural modulus



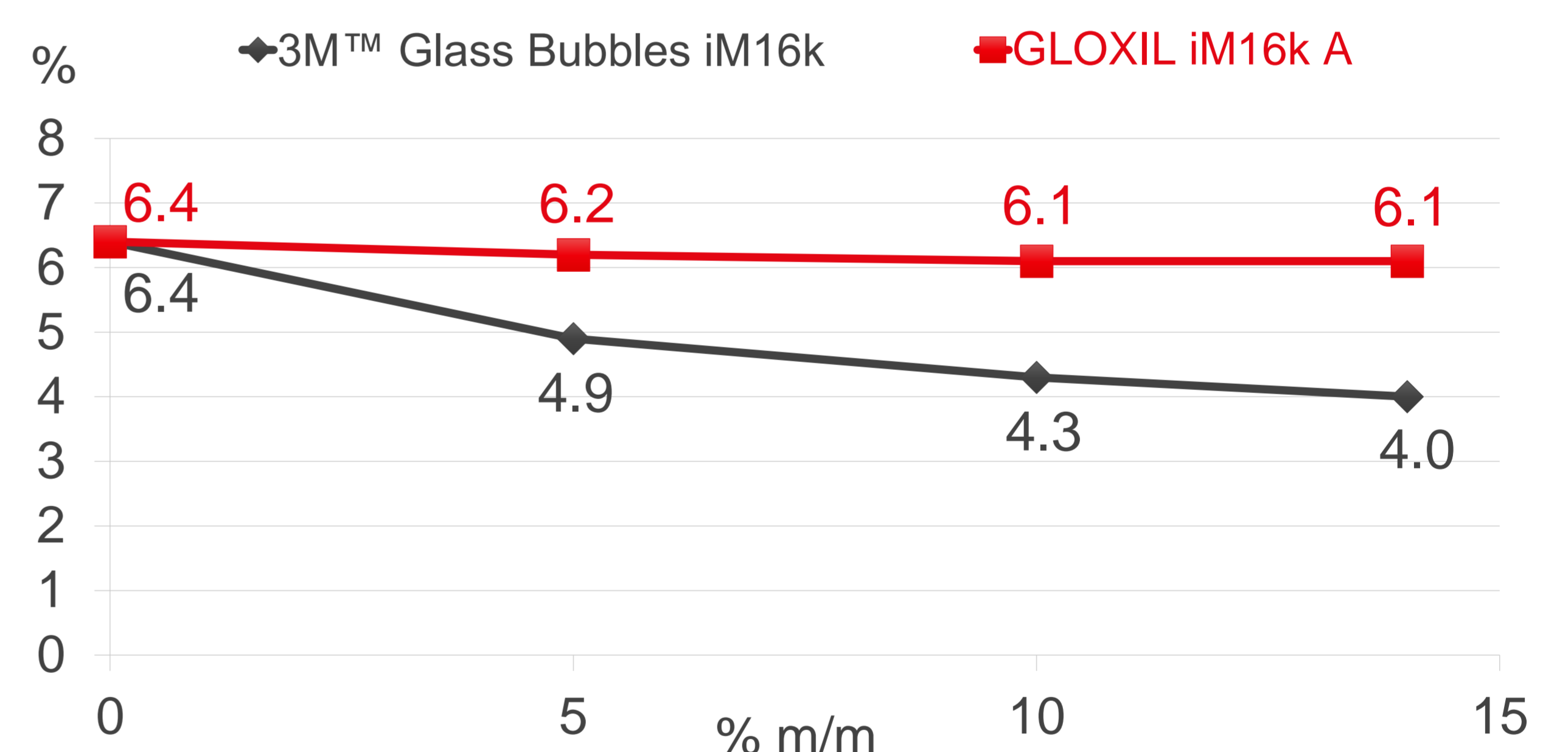
## Yield stress



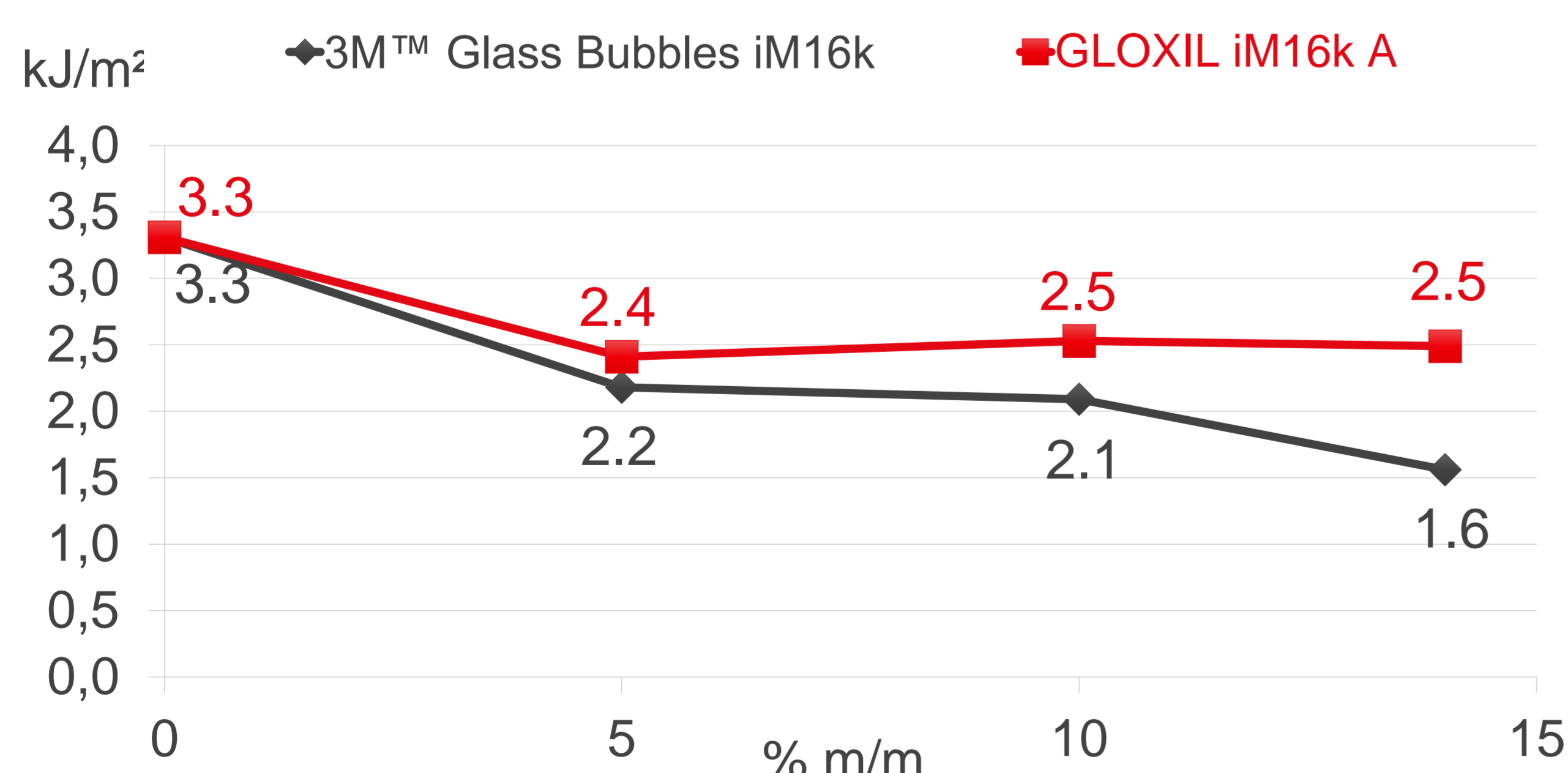
## Flexural strength



## Yield strain



## Notched impact strength charpy



## Summary

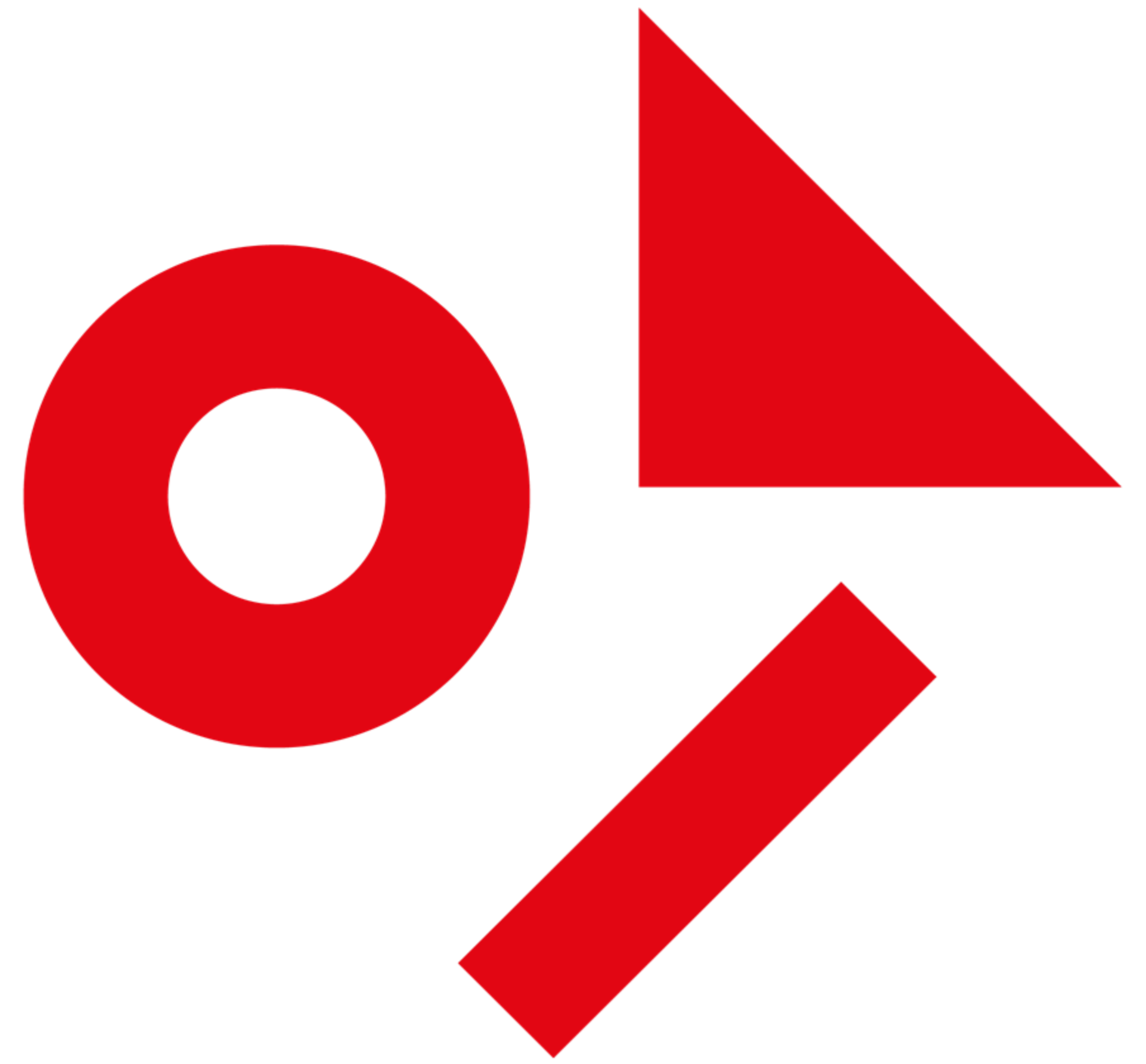
**GLOXIL iM16k A** shows in comparison to the untreated hollow glass spheres:

- Same density and thus weight saving potential
- Comparable increase in stiffness (tensile modulus and flexural modulus)
- + Significantly higher yield stress, largely independent of the filler content at the level of the unfilled PA6
- + Significantly higher yield strain, largely independent of the filler content at the level of the unfilled PA6
- + Significantly higher flexural strength, with increasing filler content even higher than the unfilled PA6
- + Slightly higher impact strength
- + Slightly higher notched impact strength

→ **Objective achieved: density / weight reduction and good mechanical properties**

- + Expectation: improved scratch resistance





---

# Gloxil iM16k A in Polyamide PA6 GF15

---



# Results

## Objective:

Increase of filler content/stiffness without increase of density/weight and still good mechanical properties

### PA compound Ultramid® B3K

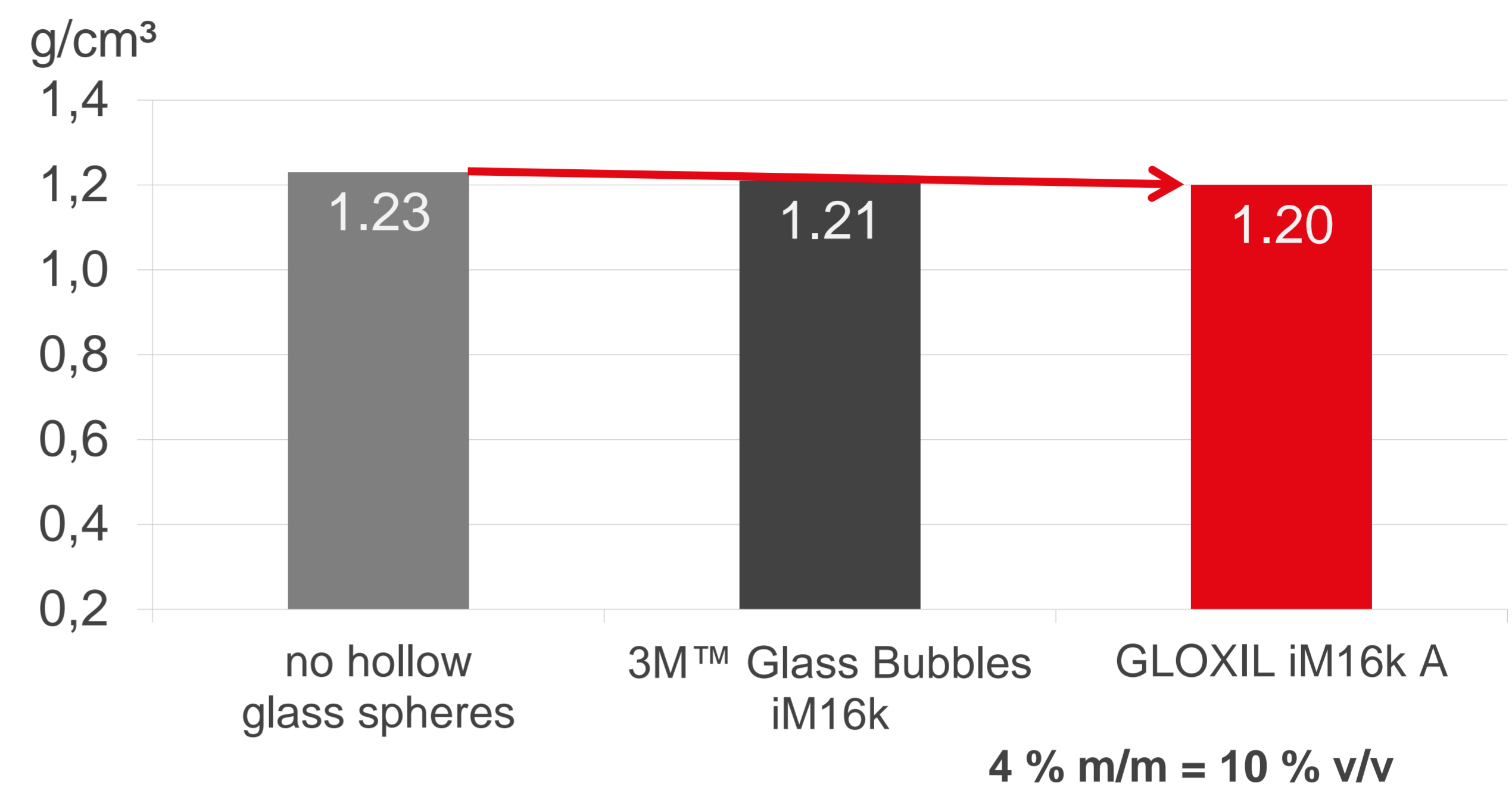
BASF

Melt volume rate MVR 160 cm<sup>3</sup>/10 min (275 °C, 5 kg)

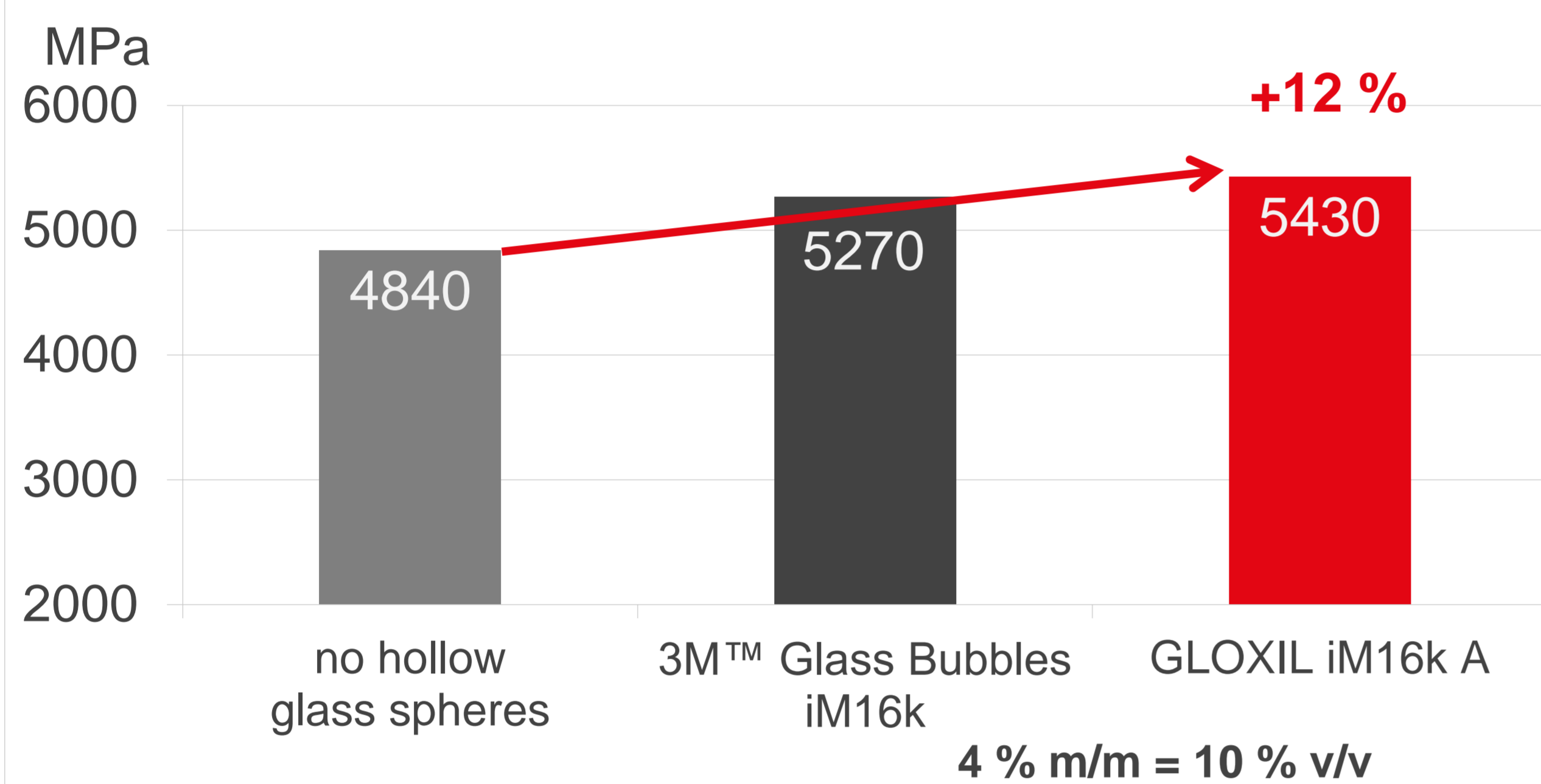
	15 % (m/m) 8 % (v/v)	17 % (m/m) 8 % (v/v)	17 % (m/m) 8 % (v/v)
<b>Glass fibers</b>			
<b>3M™ Glass Bubbles iM16k</b>	---	4 % (m/m) 10 % (v/v)	---
<b>GLOXIL iM16k A</b>	---	---	4 % (m/m) 10 % (v/v)
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Data determined by 3M Advanced Materials Division, Special Additives Laboratory

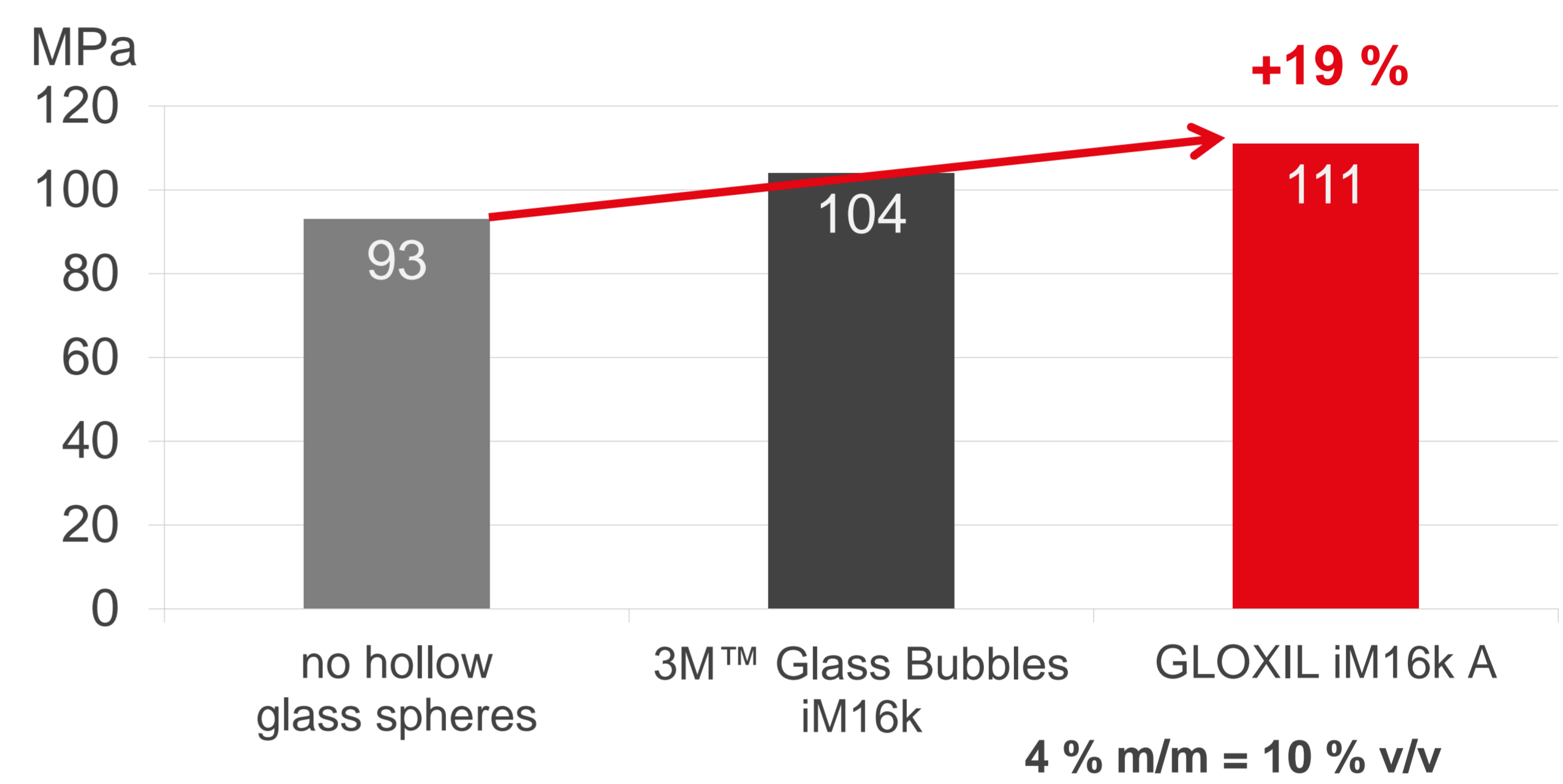
## Density (measured)



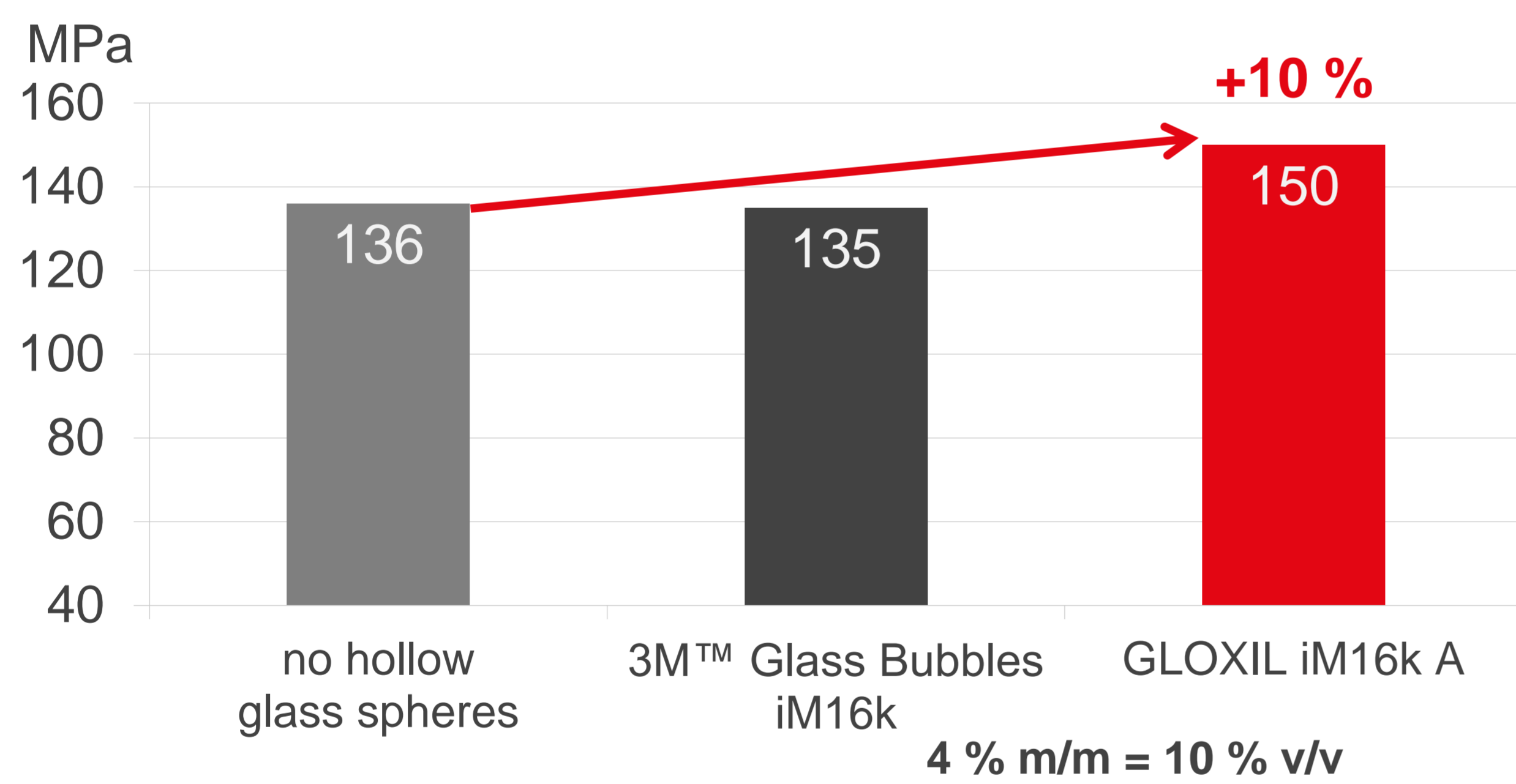
## Flexural modulus



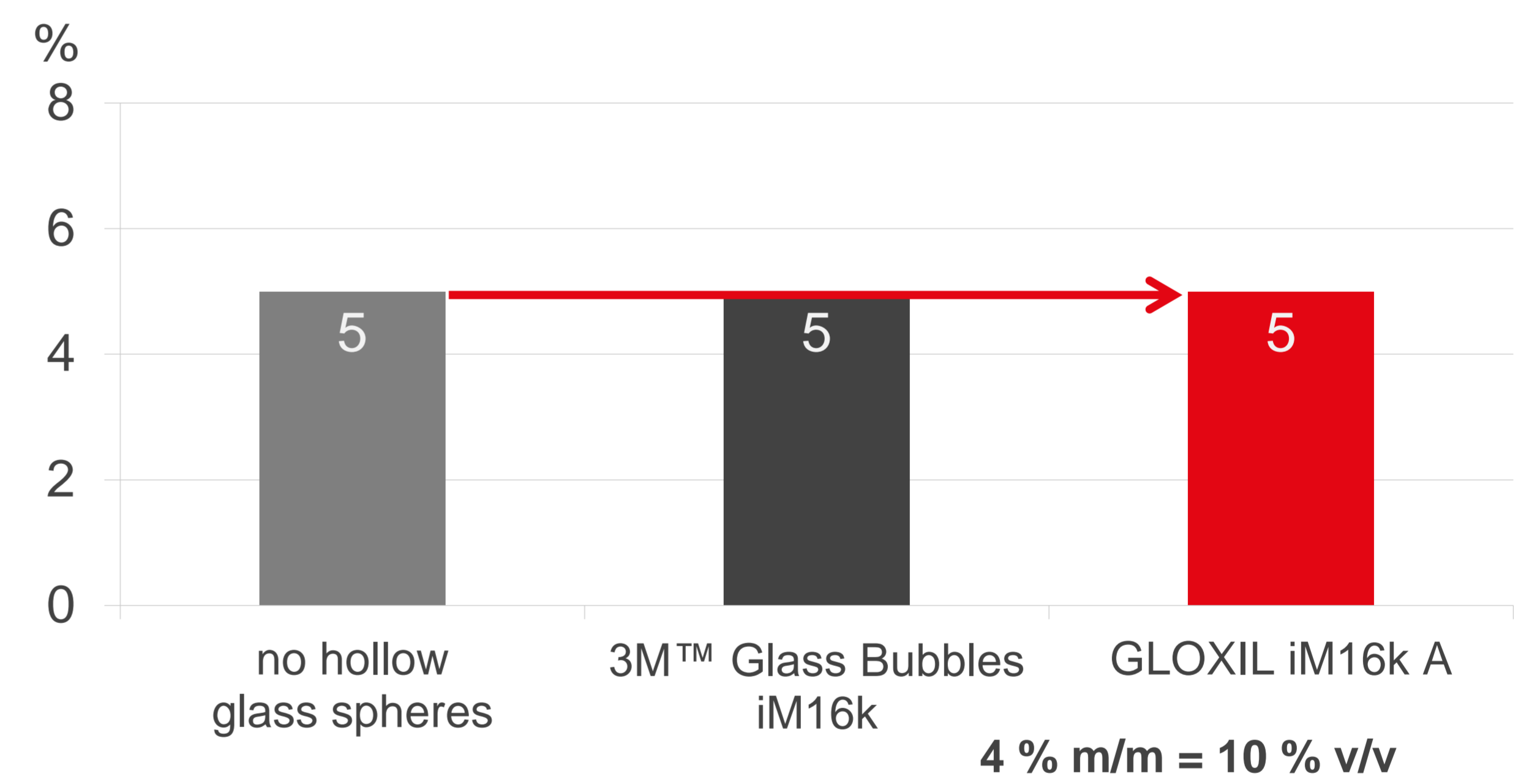
## Tensile strength



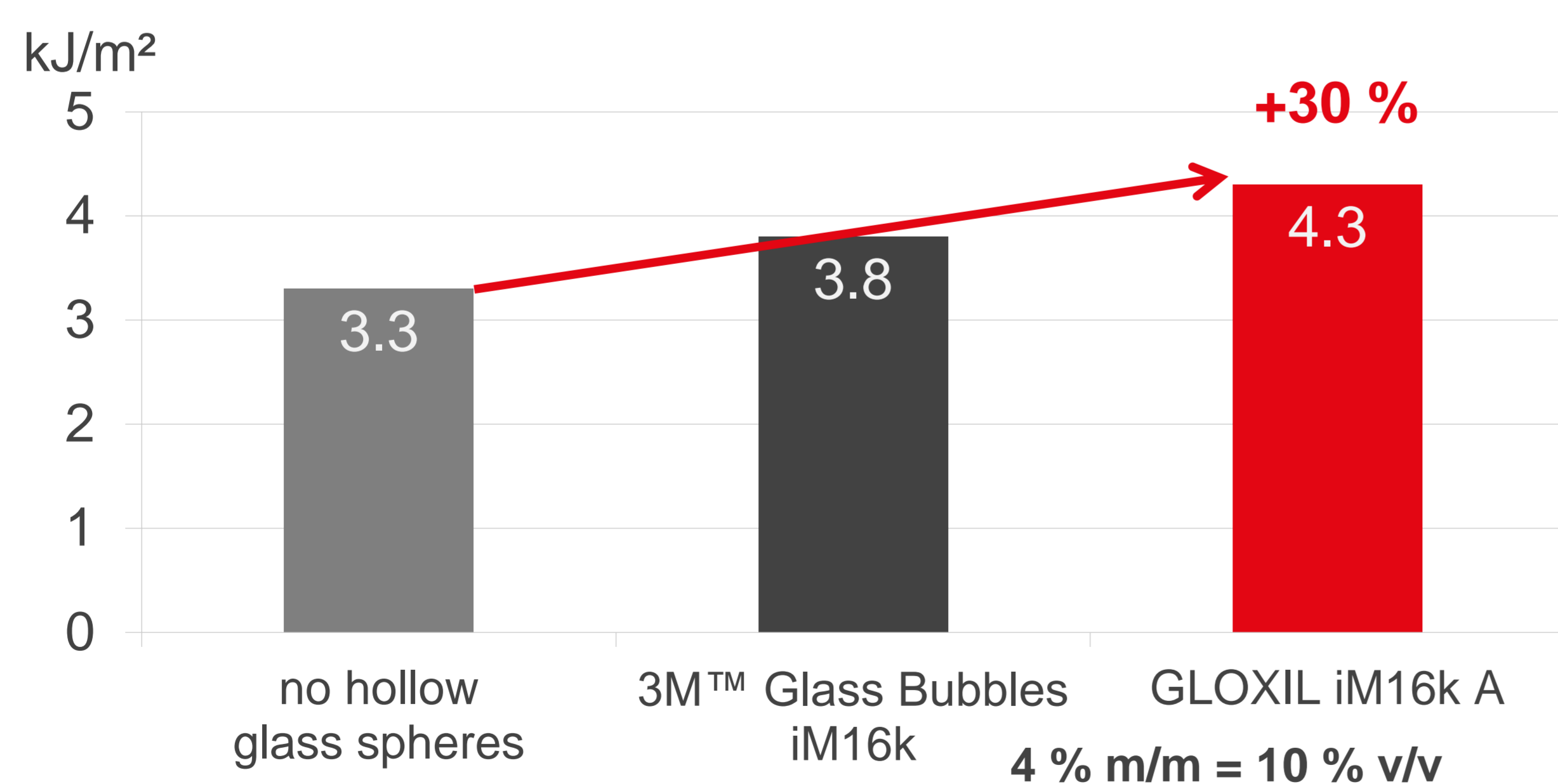
## Flexural strength



## Tensile strain at break



## Notched impact strength charpy



## Summary

**GLOXIL iM16k A** as an additive to PA6 GF 15 shows in comparison to PA6 GF 15 without hollow glass spheres:

- Slightly lower impact strength
- Slightly reduced density and thus weight saving potential
- + Increase in stiffness (tensile modulus and flexural modulus)
- + Increase in tensile strength with unchanged tensile strain at break
- + Increase in flexural strength
- + Increase in notched impact strength
- ➔ **Objective achieved:**  
**higher stiffness without increase in density / weight and good mechanical properties**
- + Expectation: improved scratch resistance

