



Alumina as functional filler for thermal management solutions

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Think alumina, think Almatris.

Corporate Profile

The market leader in specialty alumina-based products and solutions

Alumina Markets



Refractories



Ceramics



Polishing



Specialty Industries



Building Chemicals



Glass



Thermal Interface Materials



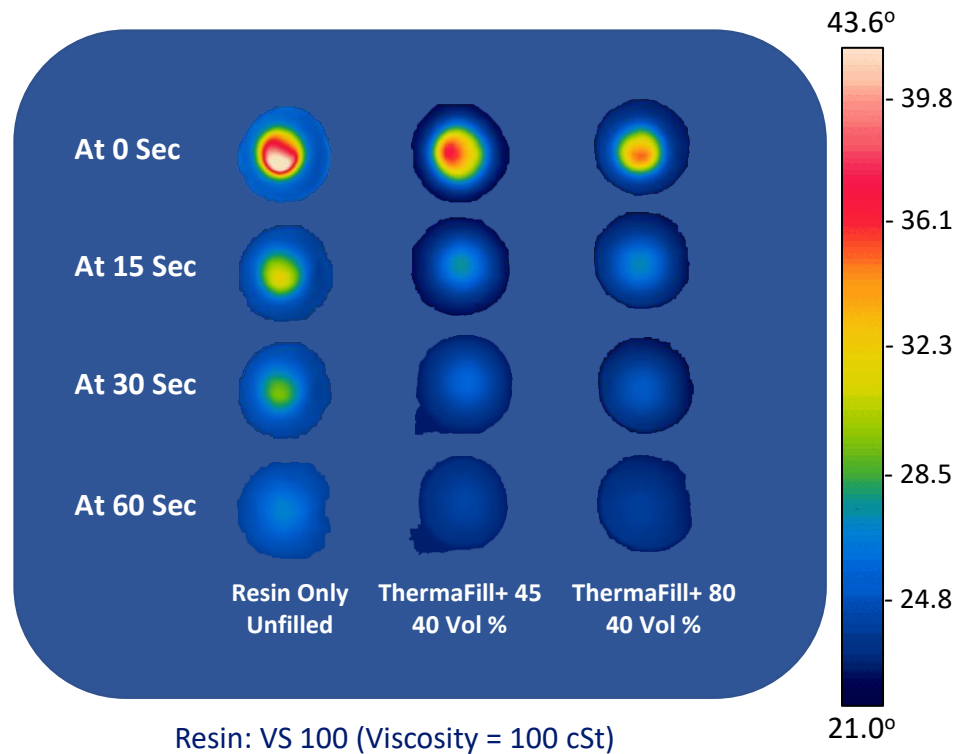
Catalyst Carriers



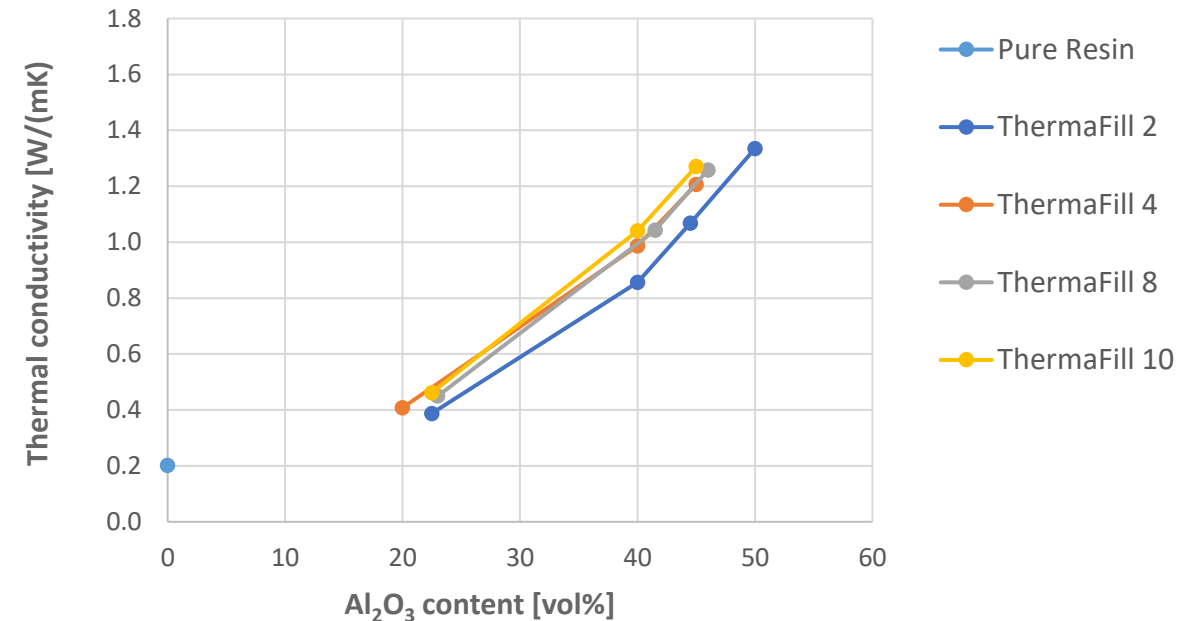
Investment Casting

Thermal conductivity of alumina in a polymer resin

Imaging of temperature decay with time



Thermal conductivity of alumina fillers

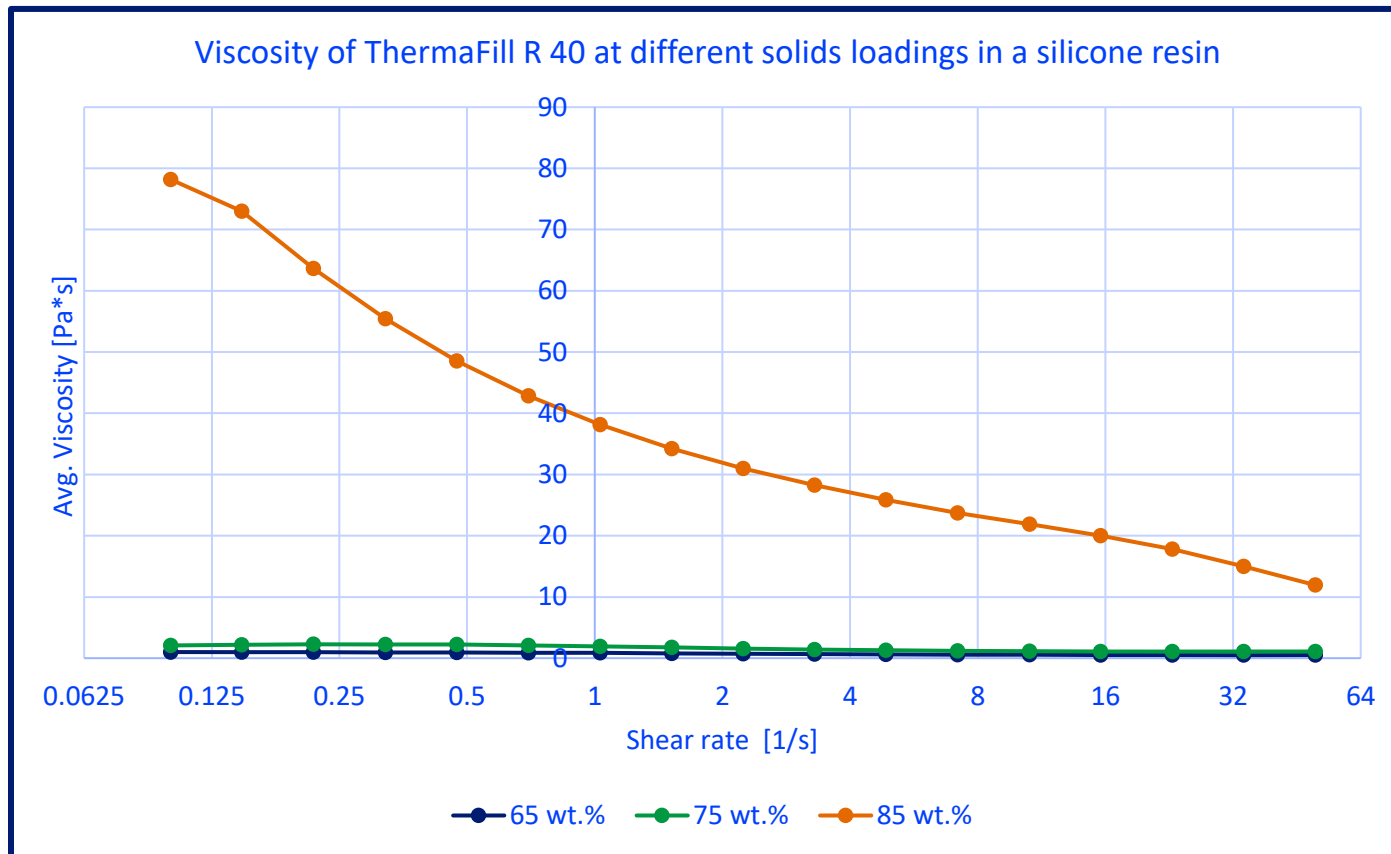


Thermal Diffusivity: DIN EN ISO 22007-2: 2015

➤ Increasing thermal conductivity with filler content in resin and particle size of alumina powders

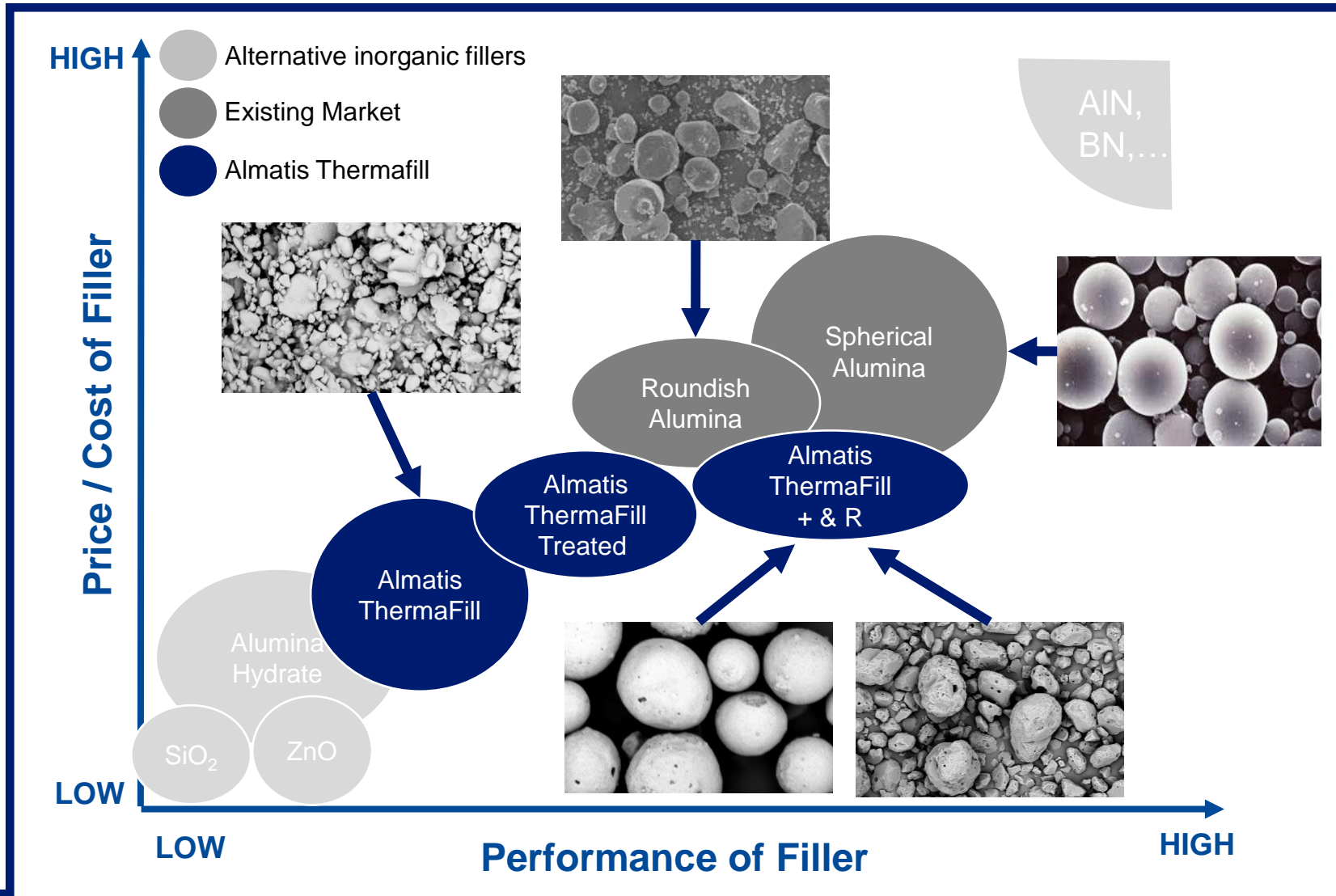
Viscosity of alumina fillers in a silicone resin

Influence of solids loading

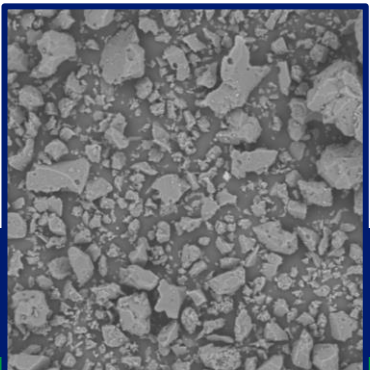
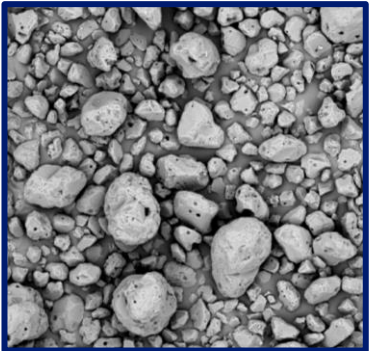
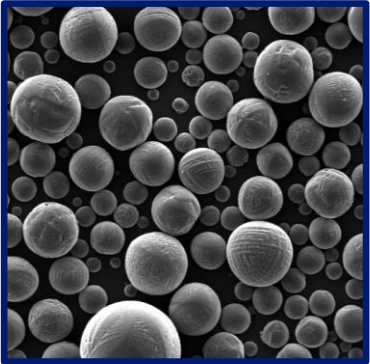


- ▶ Higher solids loading increases the thermal conductivity
- ▶ However, higher solids loadings increases the viscosity

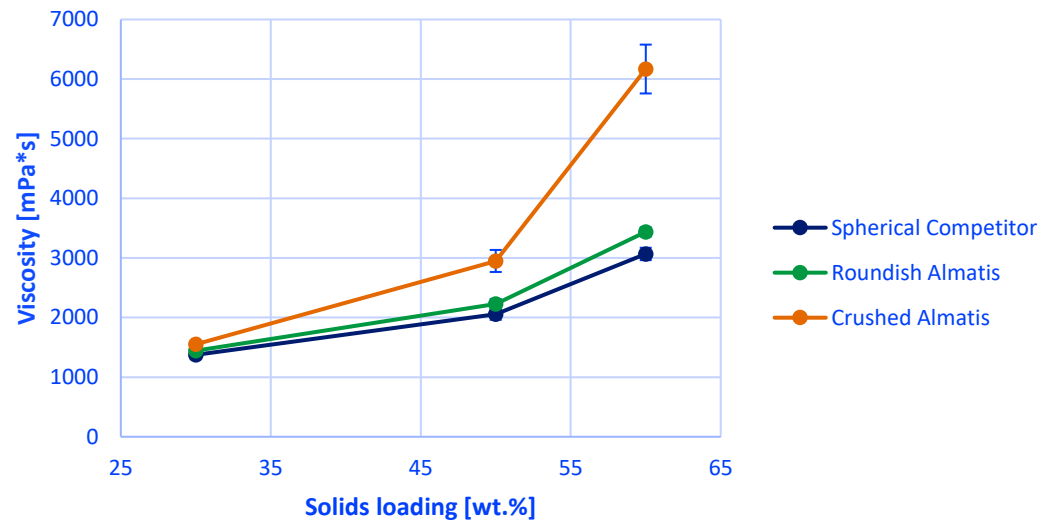
Thermal Interface Product Performance



Comparison of different filler types with a 40 μm d50 in a silicone resin



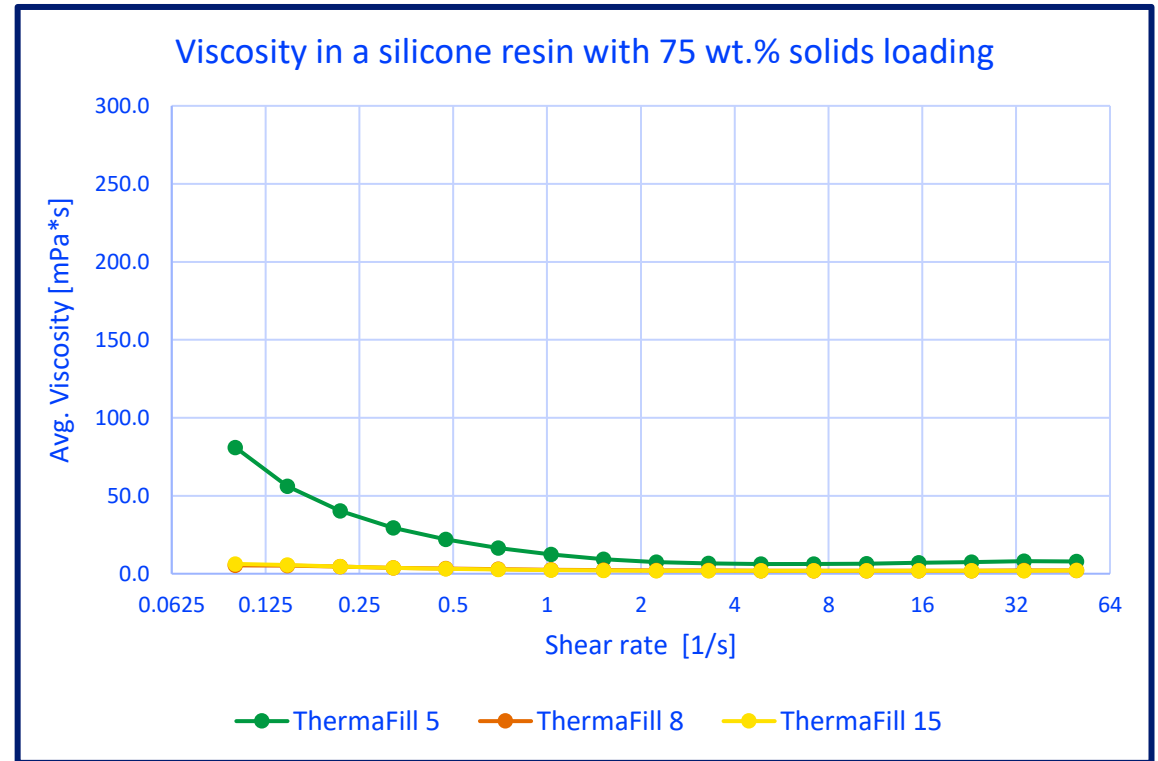
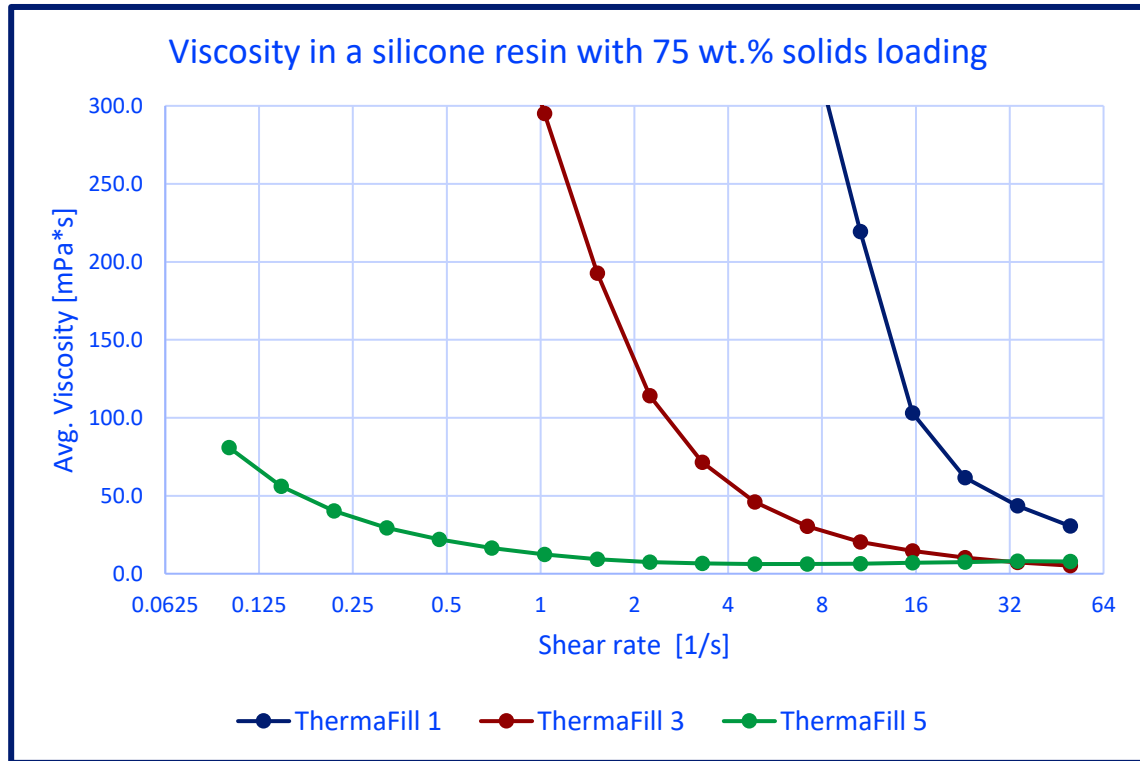
Viscosity of different alumina filler types in a silicone resin



- ▶ Improved viscosity compared to crushed
- ▶ Similar performance in viscosity of spherical and rounded alumina
- ▶ Optimized particle packing needed for higher filling grades

Viscosity of alumina fillers in a silicone resin

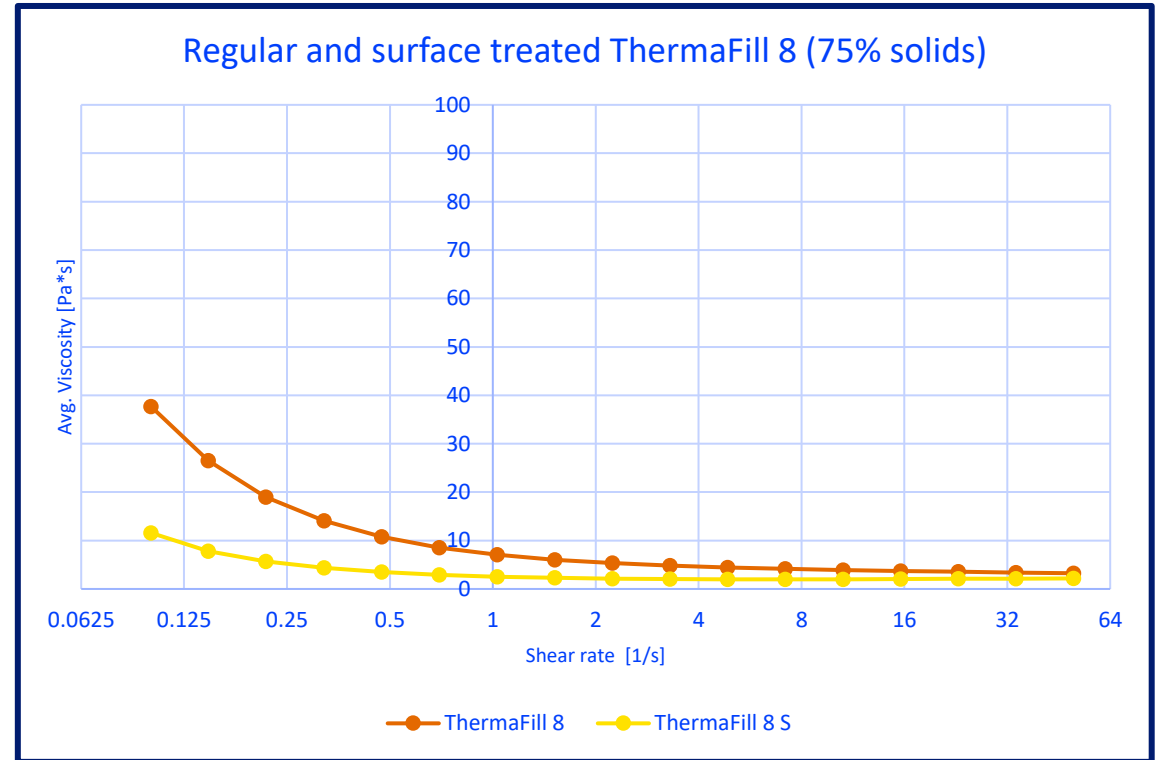
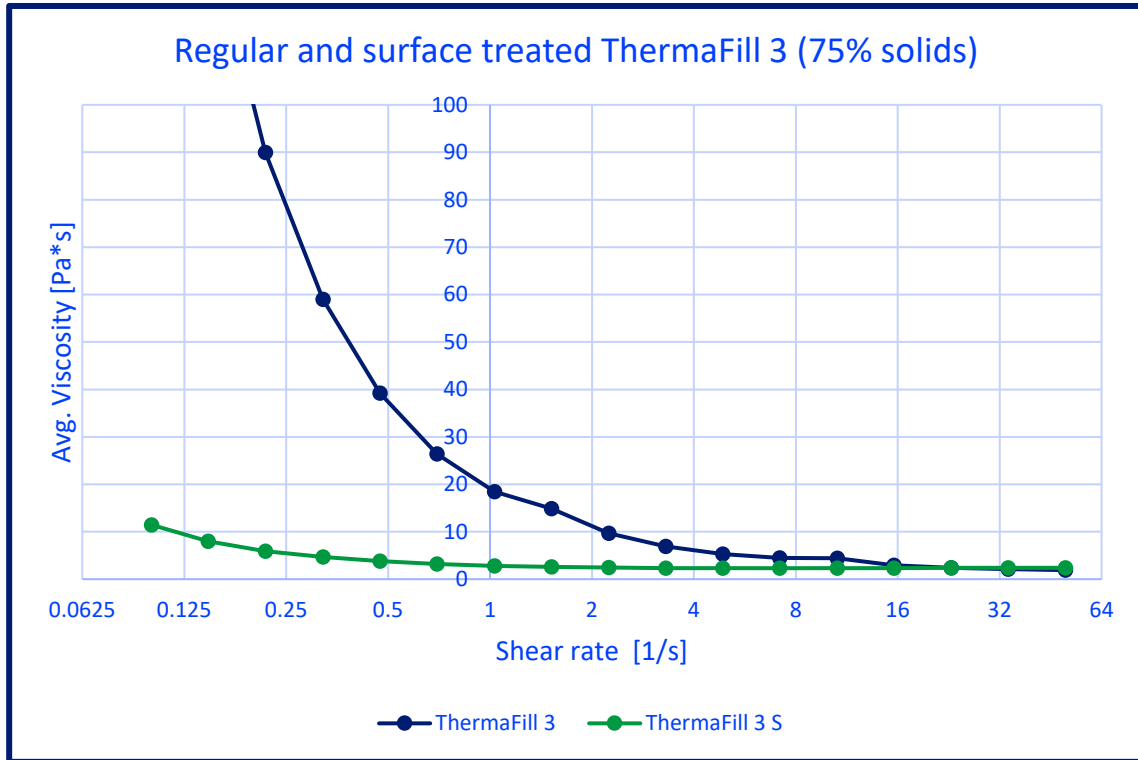
Influence of particle size



▷ Smaller particles increase viscosity

Viscosity of surface treated alumina in a silicone resin

Influence of surface treatment



- ▷ Surface treatment increases compatibility with the polymer
- ▷ Surface treatment reduces the viscosity



Diverse particle sizes for optimized **packing**

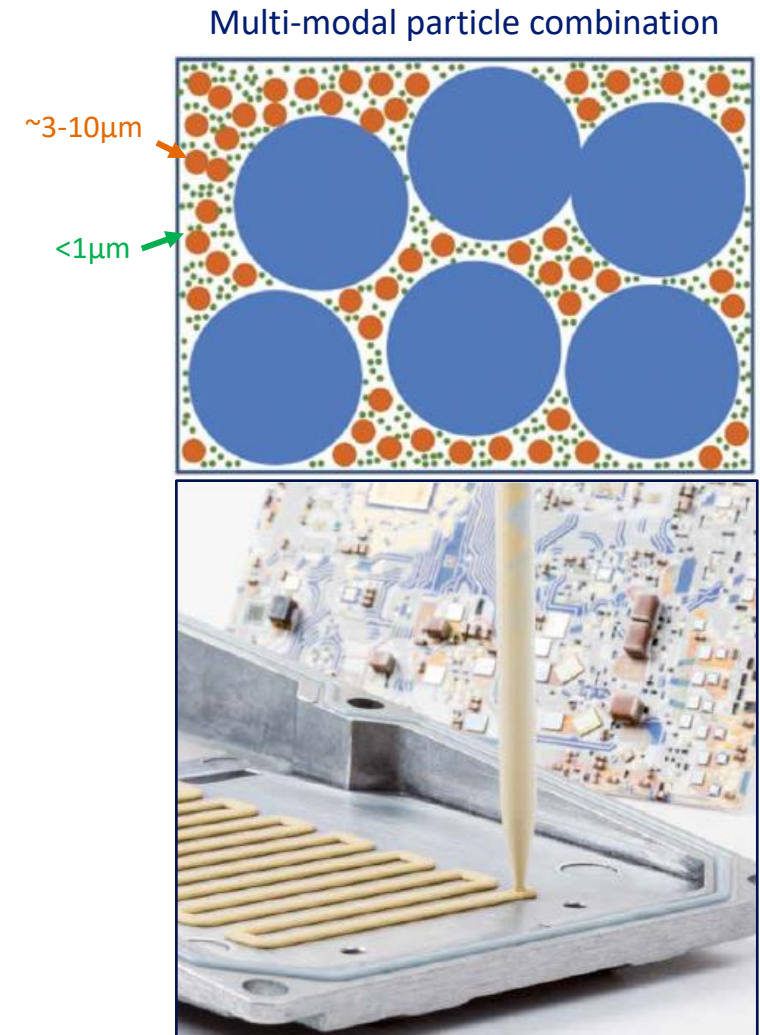
Surface treatment of alumina

Shape: Crushed (no adder) or roundish (+)

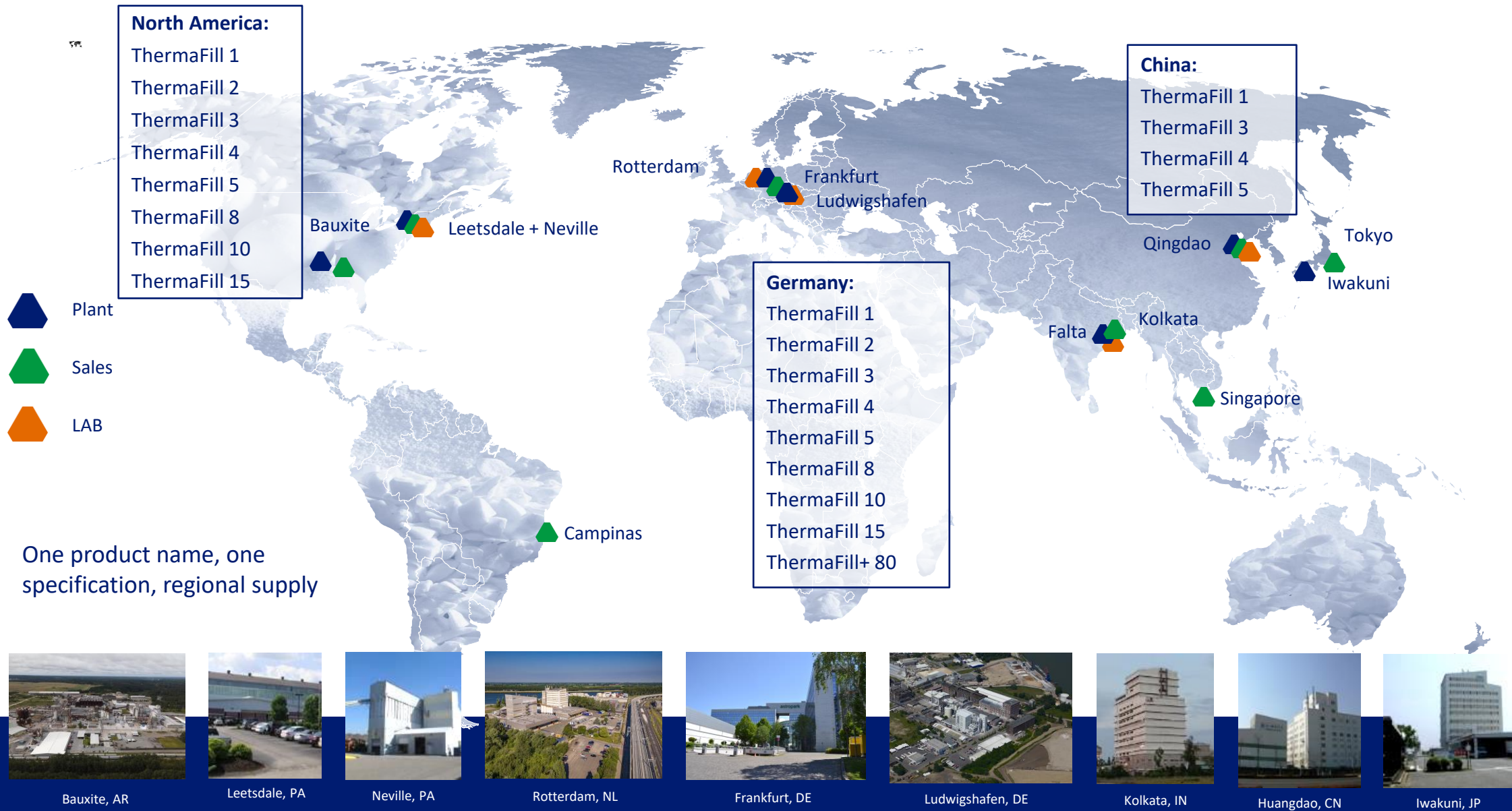
General Surface Treatment for all purposes (C) available

Individual Surface Treatment for Epoxy (E), Silicone (S), Polyurethane (P) available

Product	Median Size [μm]	Specific surface area [m^2/g]
ThermaFill 1	0.5	7
ThermaFill 2	1.2	3
ThermaFill 3	2.8	3
ThermaFill 4	3	2
ThermaFill 5	4	0.9
ThermaFill 8	8	0.5
ThermaFill 10	10	0.8
ThermaFill 15	15	0.4
ThermaFill+ 80	75	0.25



Global supply of alumina and ThermaFill grades



Take aways for today

- Alumina can be used in various applications including thermal interface materials
- Different shapes of alumina are available
- Dense packing increases the thermal conductivity but also the viscosity
- Particle shape influences the viscosity
- Surface treatment can improve behavior in the resin

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