



Effects of fillers on the properties of liquid silicone rubbers (LSRs)

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Publication date:
2014

Document Version
Peer reviewed version

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Citation (APA):

Yu, L., Vudayagiri, S., Zakaria, S. B., & Skov, A. L. (2014). Effects of fillers on the properties of liquid silicone rubbers (LSRs). Sound/Visual production (digital)

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Effects of Fillers Depend On

Particle Size

Particle Surface Area

Particle Shape

Particle Surface Activity
 (Compatibility With/Adhesion To Matrix)

Particle Shape

Broader (and Longer) is Better

Isometric		Platy	
Acicular		Fiber	
		Cluster	

Particle Size
 Smaller is Better

>10µm: Degradants
1-10µm: Diluents
0.1-1µm: Semi-reinforcing
0.01-0.1µm: Reinforcing

Particle Surface Area

Bigger is Better

size ↓ surface area ↑

Particle Surface Activity

More is Better

Poor contact

Good contact

Bonded

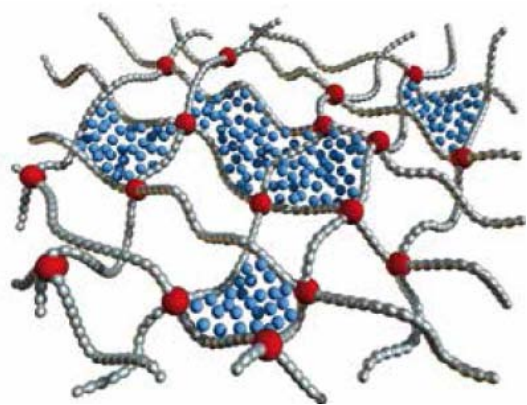
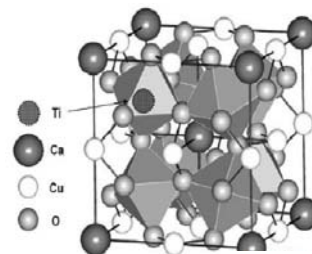
Matrix wetting

Matrix adhesion

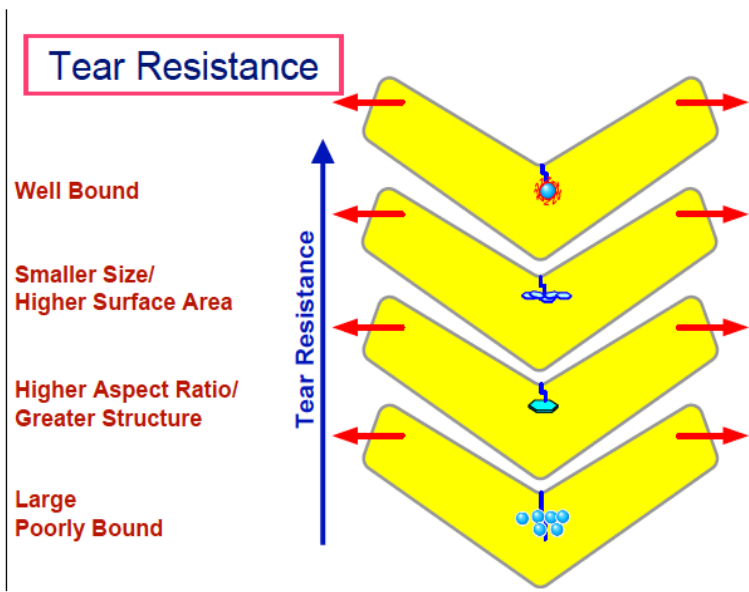
SiO₂ reinforces the networks with no increase in **permittivity** ($\epsilon_{r, SiO_2} \sim 3.9$).

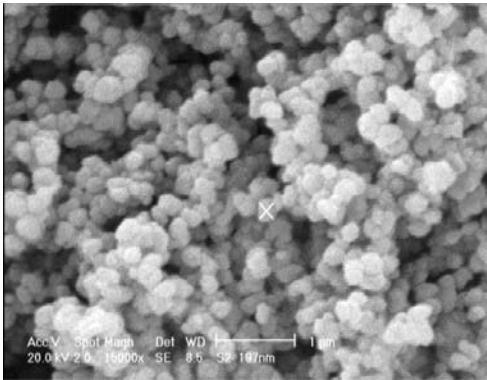
The **inhomogeneous** compatibility of the **unmodified multiwalled carbon nanotubes (MWCNTs)** causes the risk of **conductivity**.

Micron-sized CaCu₃Ti₄O₁₂ CCTO ($\epsilon_{r, CCTO} \sim 10000$) decreases the **mechanical properties** of the composites.

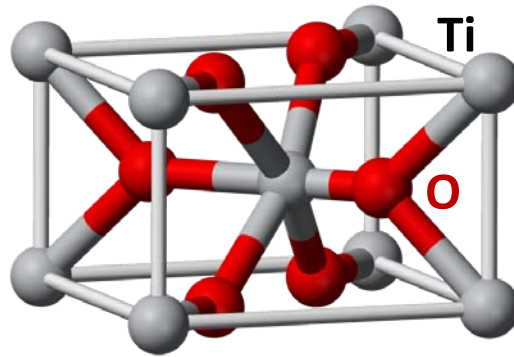


Polymer with chemical crosslinks (red) forms a filled, elastic network



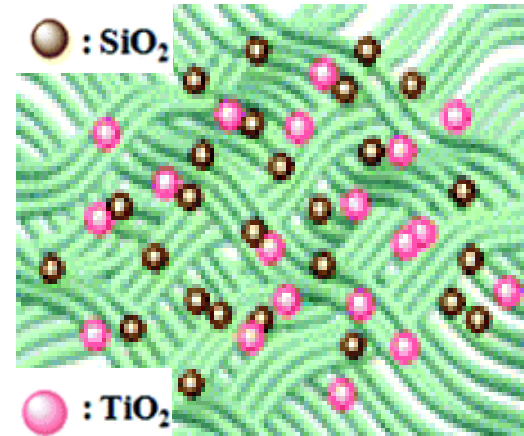


Nano-sized: 25-250nm
Spherical particle



Rutile ϵ_r : 114-180

Hydrophobic: modified polysiloxane



	Tear strength (N/mm)	Relative permittivity ϵ_r @ 0.1Hz	Young's modulus γ (MPa)	Breakdown strength (V/μm)
LSR	6.6	2.8	0.8	130
LSR/TiO₂	20	5.5	1.0	150

ACKNOWLEDGMENTS

The authors gratefully acknowledge the financial supports from the InnovationsFonden and Danfoss Polypower A/S. Participation to this conference was partially supported by COST (European Cooperation in Science and Technology) in the framework of ESNAM (European Scientific Network for Artificial Muscles) - COST Action MP1003, which is also acknowledged.