Cluster 4. Functional materials project C16029
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Chemical vapor deposition and plasma polymerization to produce functionalized silica

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Introduction

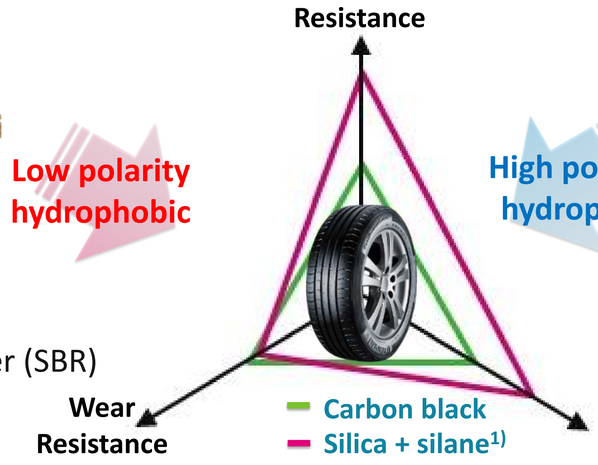
Aim : Novel silica filler system for tire

- Good processibility (easily dispersible)
- Eco-friendly (no hazardous emissions)
- Improving tire performance (Rolling resistance, Wet grip,..)

Rubber

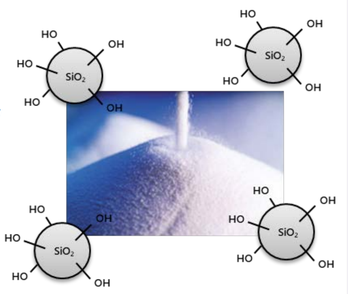
- Natural rubber (NR)
- Styrene-Butadiene rubber (SBR)
- Butadiene rubber (BR)

Low polarity hydrophobic



High polarity hydrophilic

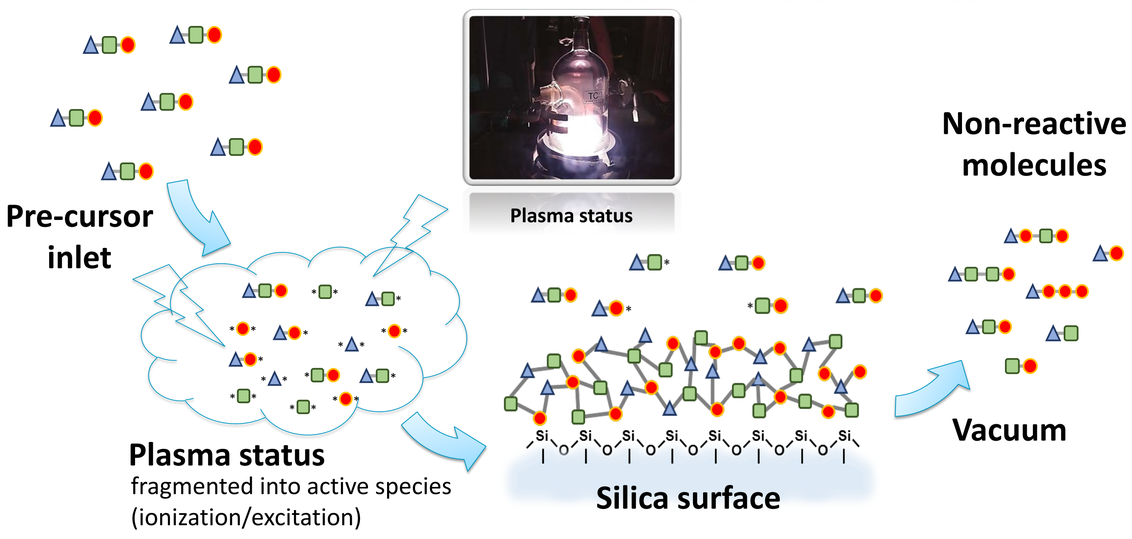
Silica



Plasma Polymerization

Reaction mechanism

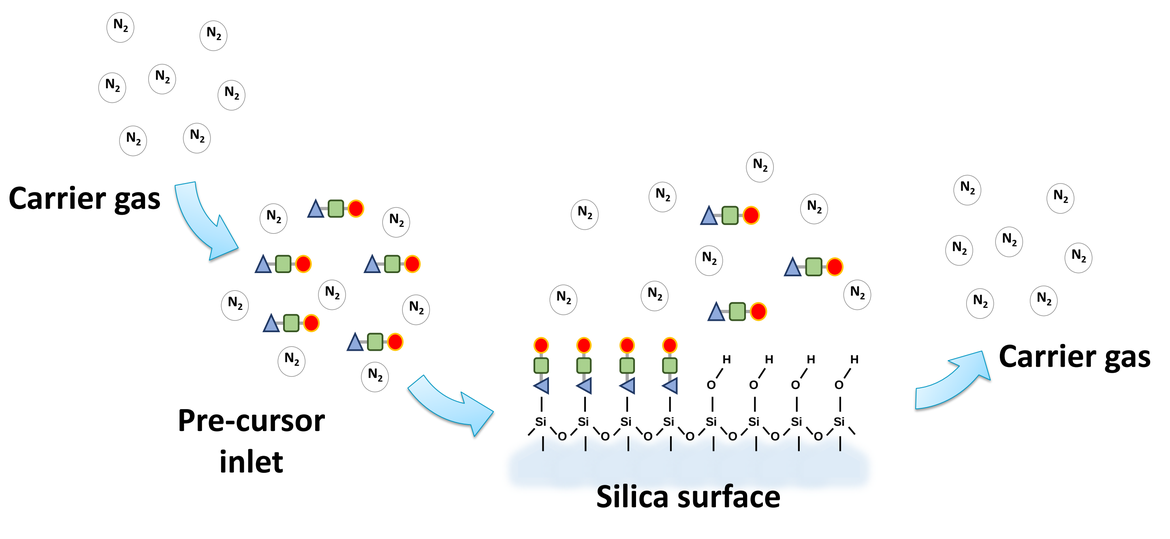
Plasma : 4th state of matter



Strengths	• Substrate independent process • Least alteration of bulk properties of substrate • Wide choice of precursors
Weaknesses	• Unknown reaction mechanism • More difficult upscaling

Chemical Vapor Deposition

Reaction mechanism



Strengths	• Adjustable reaction conditions • Known reaction mechanism • Easier to scale up
Weaknesses	• Needs specific precursors having affinity to the substrate • Pre-conditioning or multi step reaction (if needed)

Outlook

- Surface energy of treated silica close to polymer matrix for improved compatibility and dispersibility
- Contains moieties after deposition, which can react with the polymer during vulcanization

1) R. Rauline, US Patent 5227425 (1992)

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