



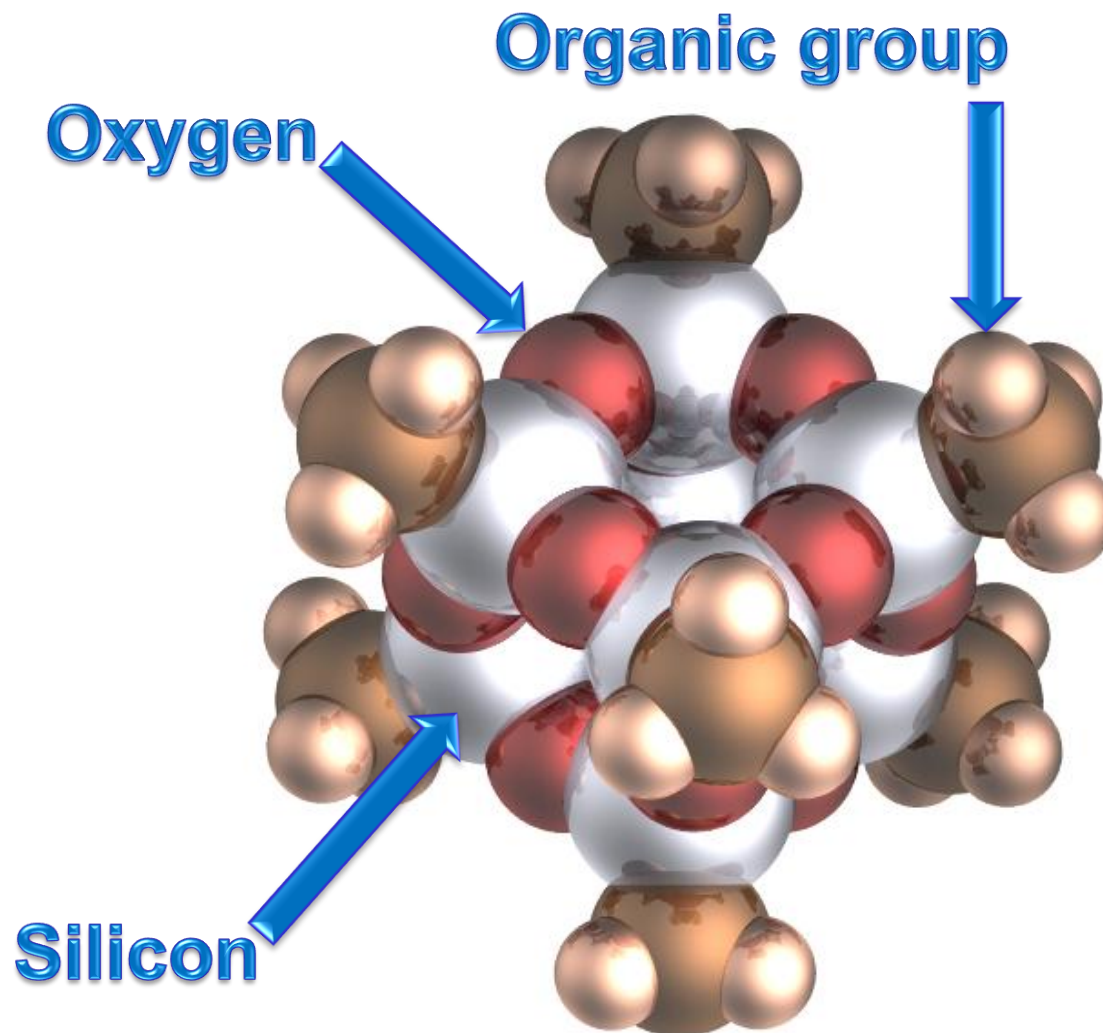
POSS[®] Flow Enhancers Dispersants & Lubricants

Dr. Chris DeArmitt FRSC
Chief Scientist

Overview

- What is POSS[®]?
- POSS[®] Flow enhancers
- Dispersants for pigments & fillers
- Lubricants
- POSS[®] production and safety
- Conclusions

POSS[®] Molecular Structure

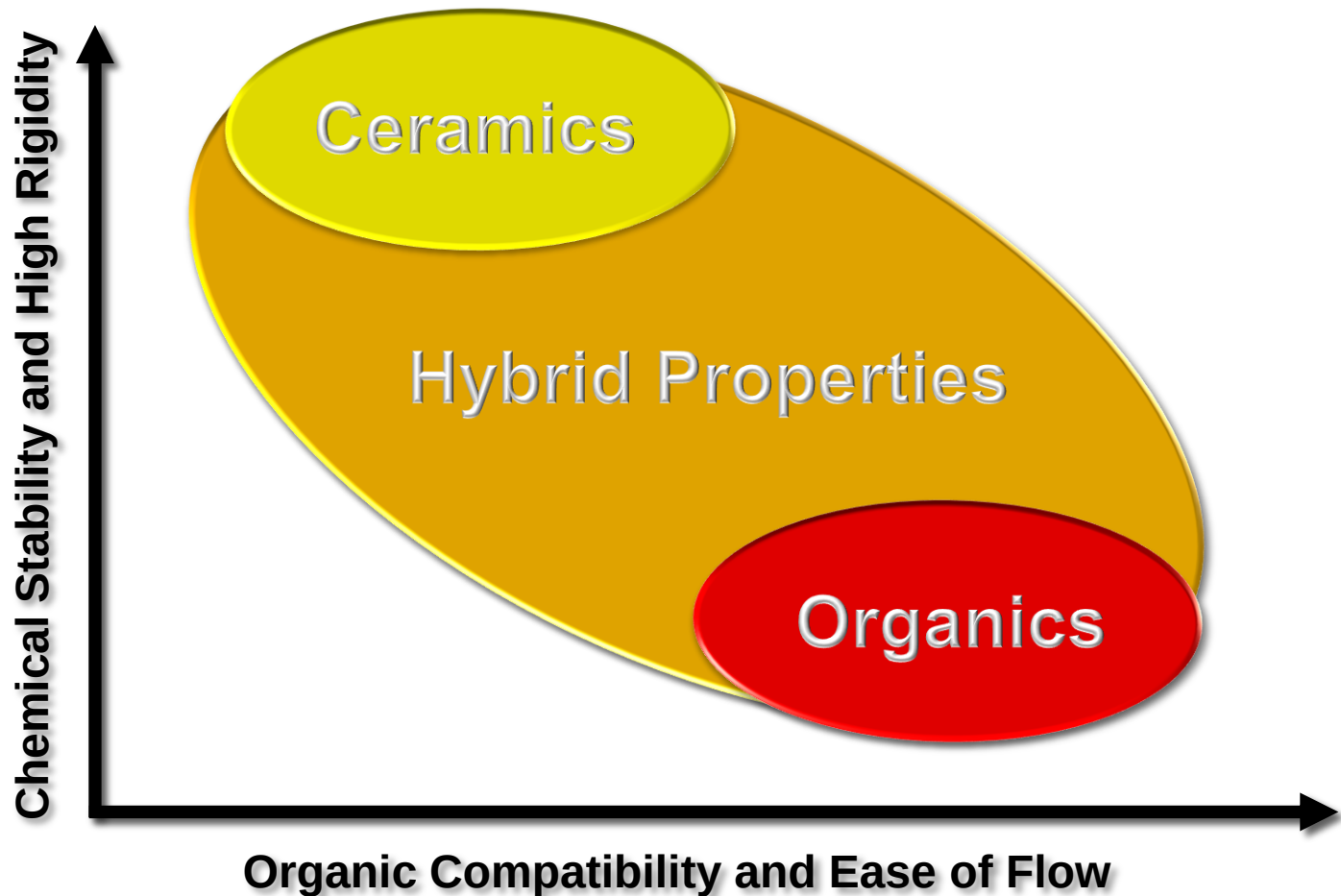


Organic Groups

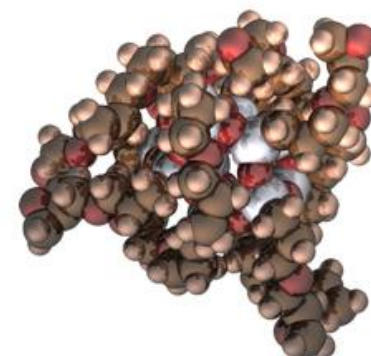
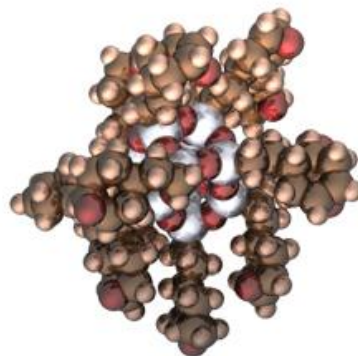
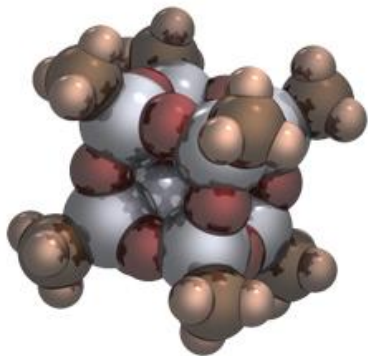
- Silane (-Si-H)
- Methyl
- Ethyl
- iButyl
- iOctyl
- Phenyl
- Acrylate
- Methacrylate
- Epoxy
- Vinyl
- Fluoroalkyl
- Alcohols
- Amines
- Thiols
- Carboxylic acid
- Sulfonic acid
- PEG/PEO
- etc...

Why Hybrid Materials?

POSS[®] is a **unique** hybrid organic-inorganic composition



What does POSS[®] look like?



Solid



Semi-solid



Liquid

What can POSS[®] do for you?

Increased T_g

Lubrication

Hydrophobicity

Flame retardance

Biocompatibility

Oxidation
resistance

Reduce friction

Permeability

Solvent resistance

Low volatility

Catalytic activity

Improved Flow

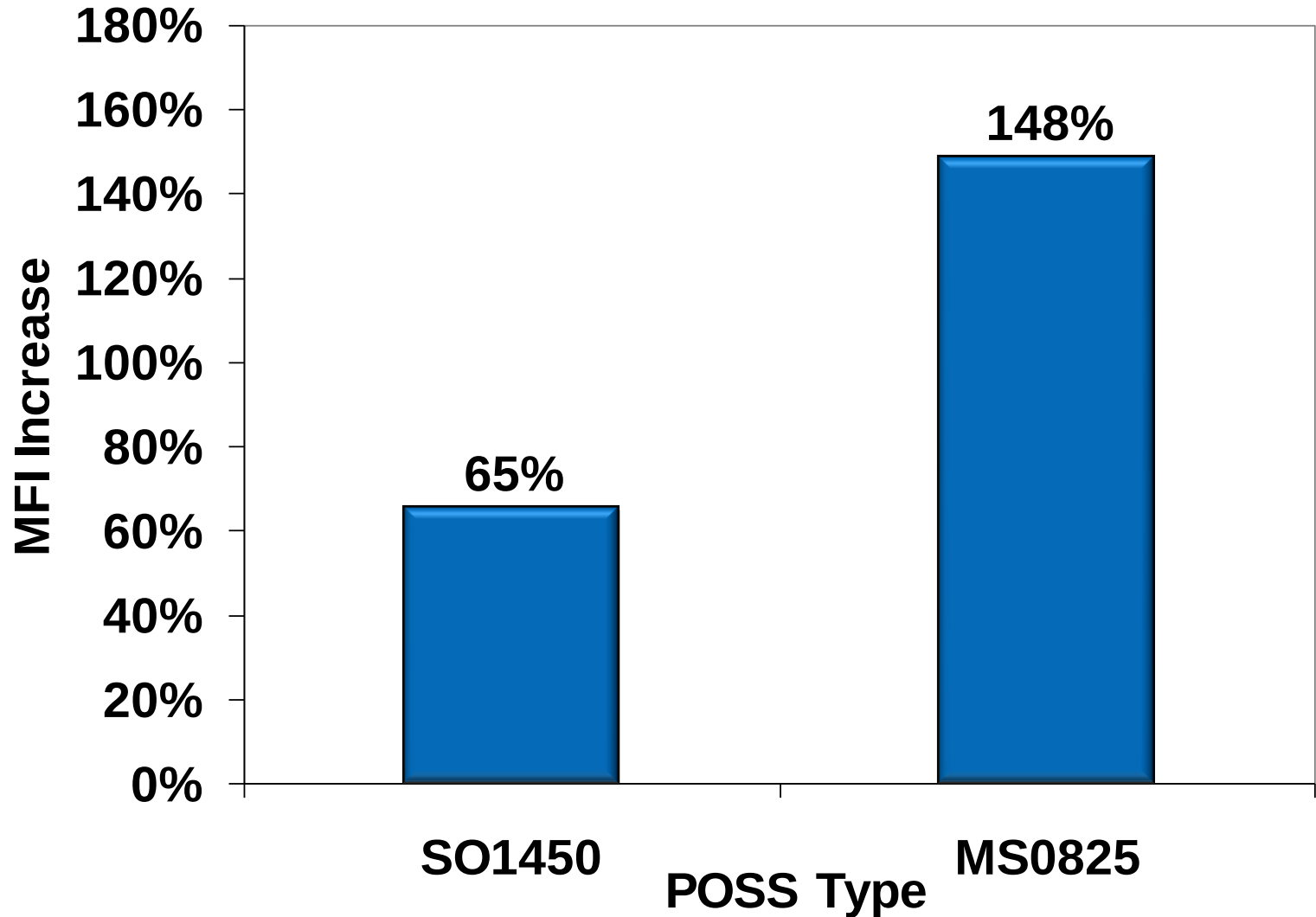
Passivation

As a dispersant

New Patents

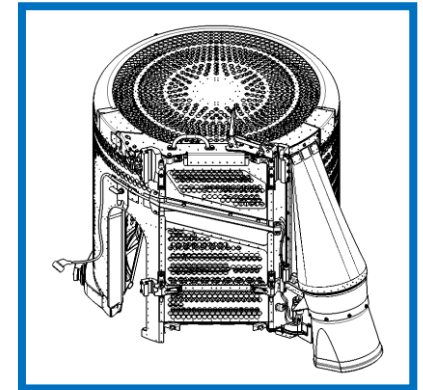
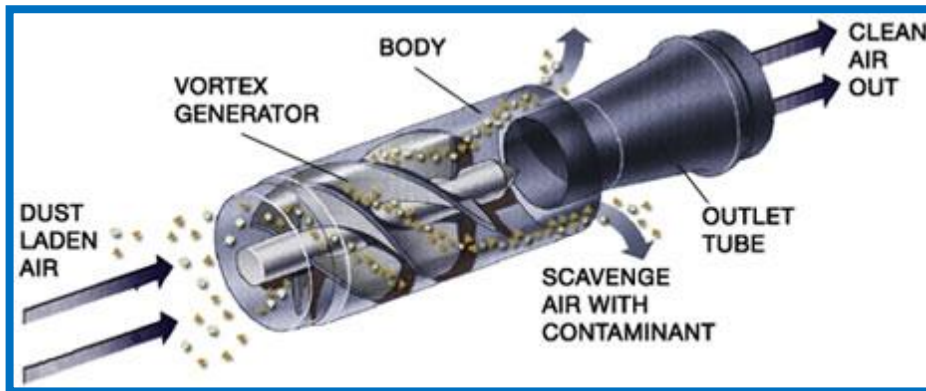
POSS[®] Flow Aids

Flow Enhancement in COC (5% POSS[®])



260°C 2.16kg

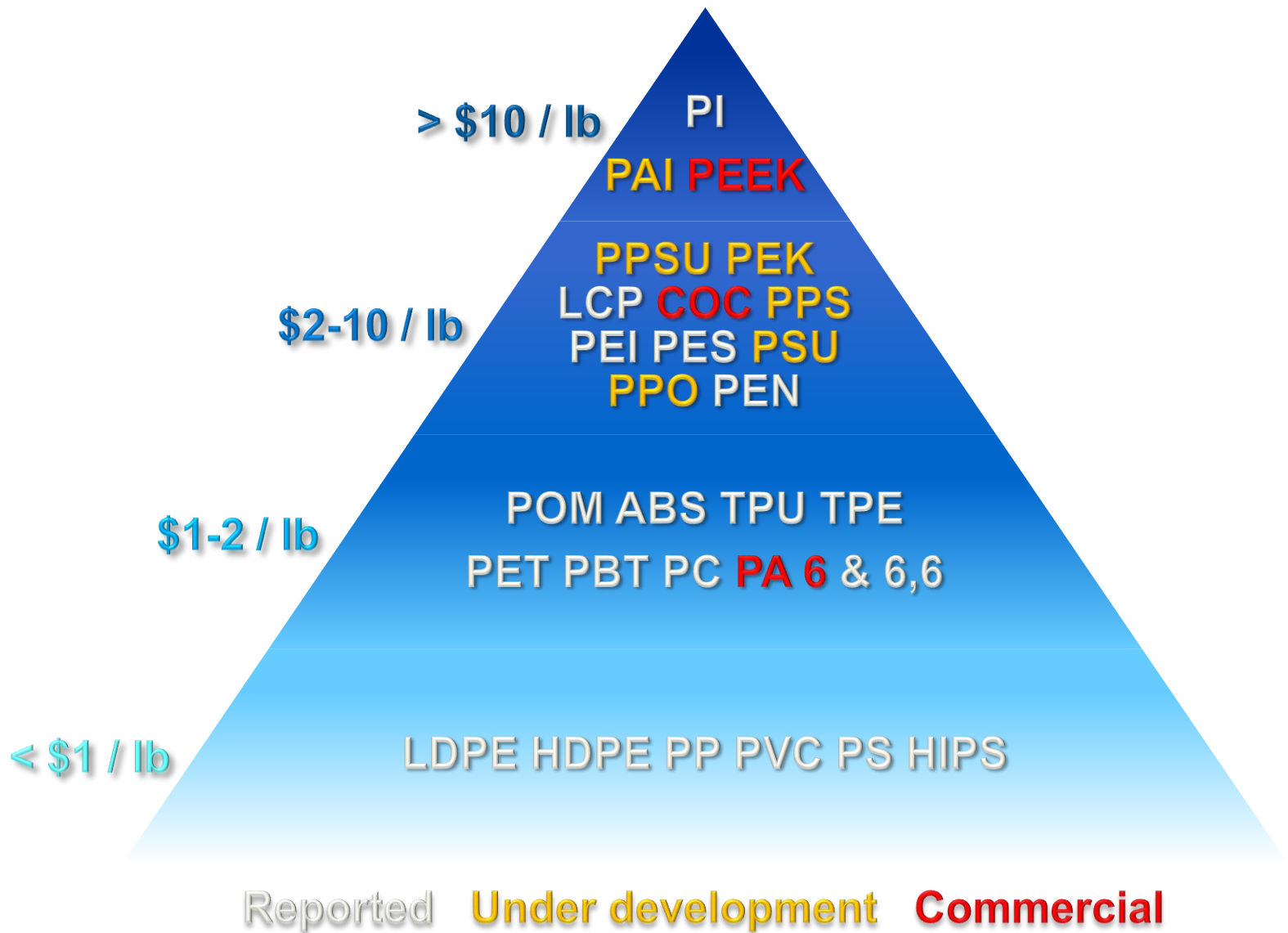
Vortex Separator Tube



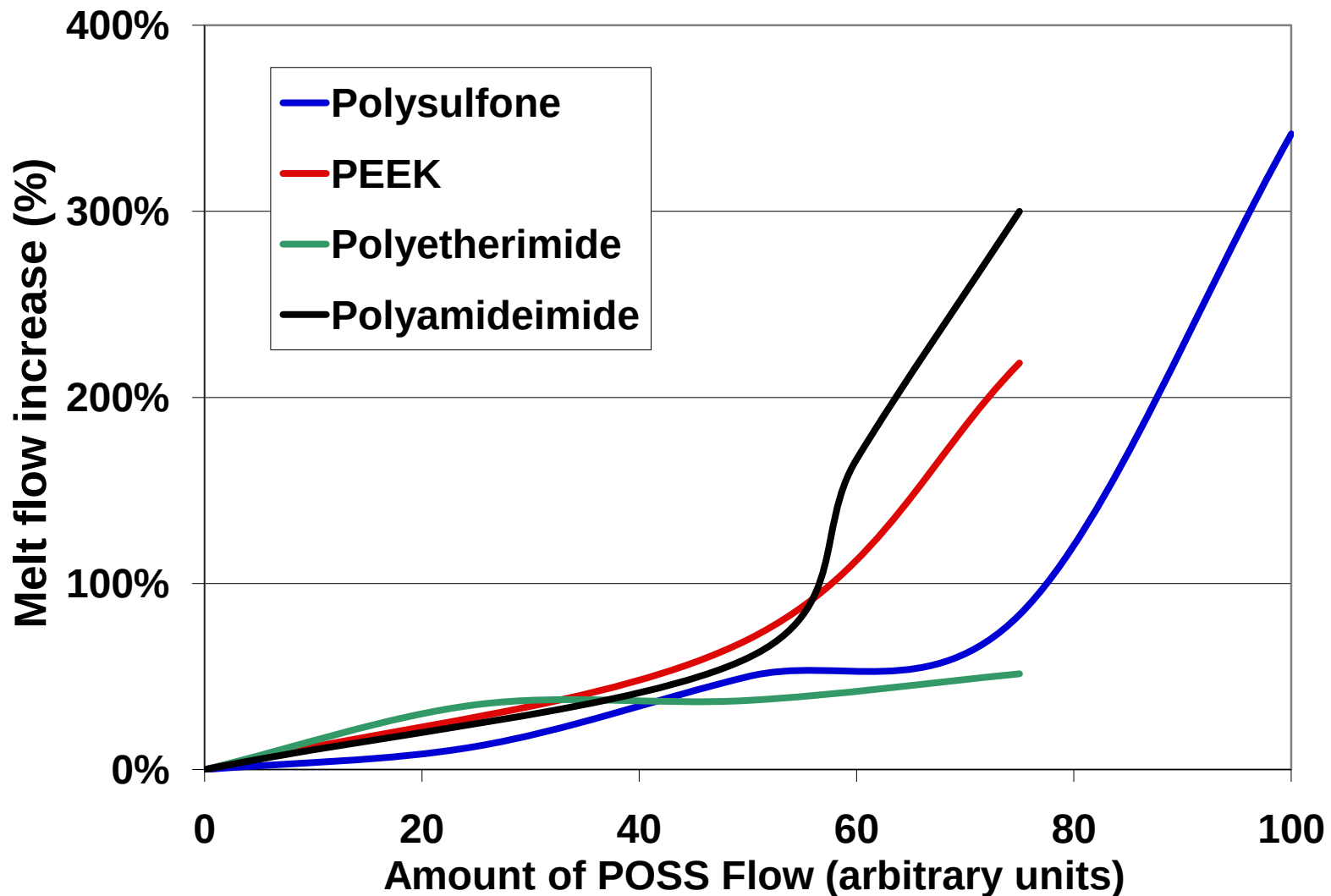
Nanoreinforced[®] Cyclic Olefin Copolymer

- POSS[®] needed to mold thin-walled part
- Weight reduction (30%) compared to GF/FR PP
- Retained mechanical/thermal performance
- Improved anti-icing
- Reduced dust build-up
- Increased operating temperature range

POSS[®] Thermoplastics Commercialization

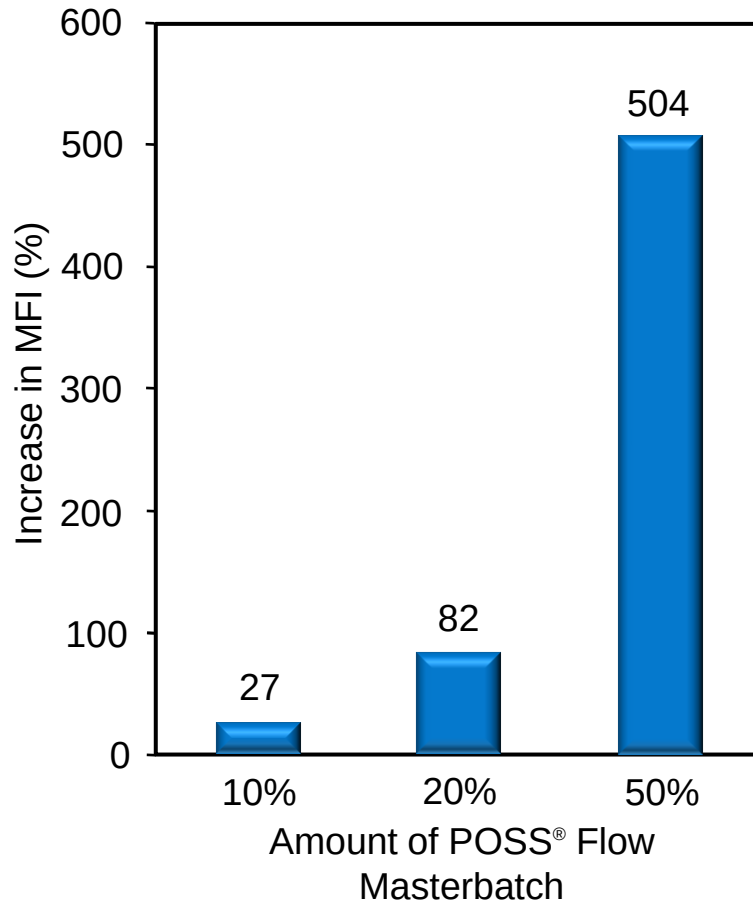


POSS[®] Flow Masterbatches

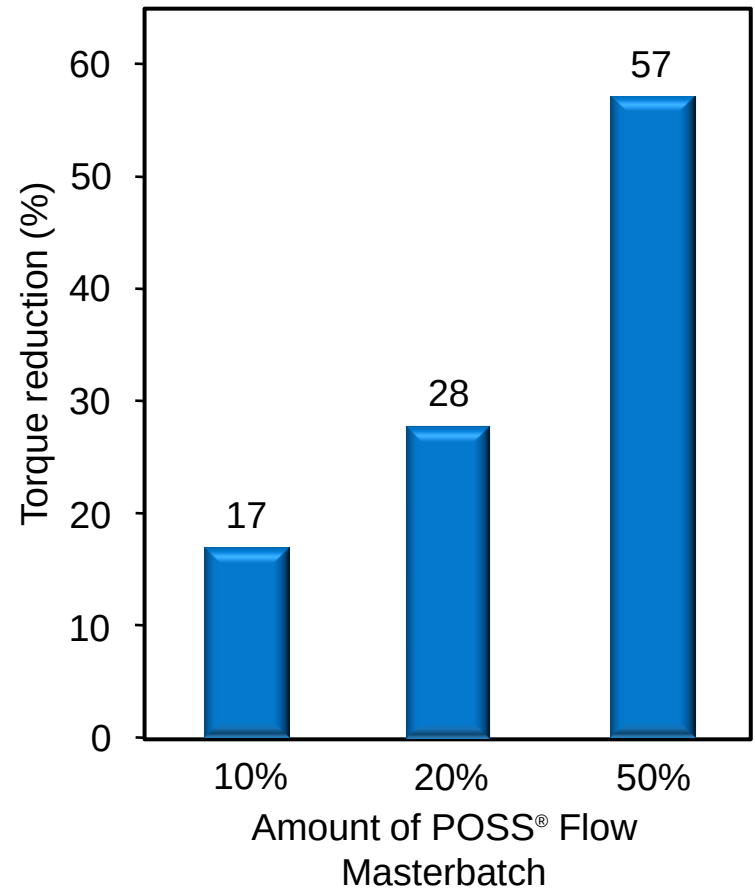


POSS[®] Flow PEEK Masterbatch

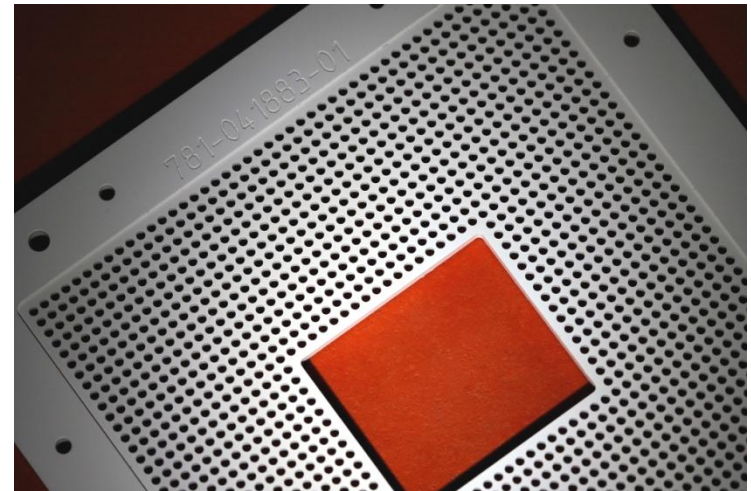
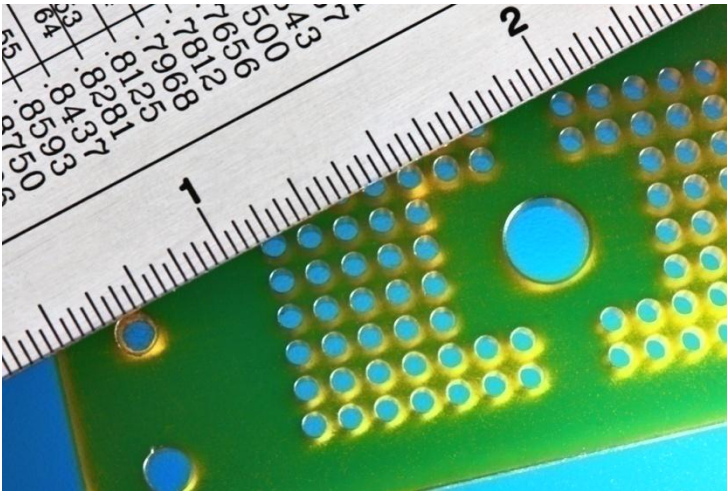
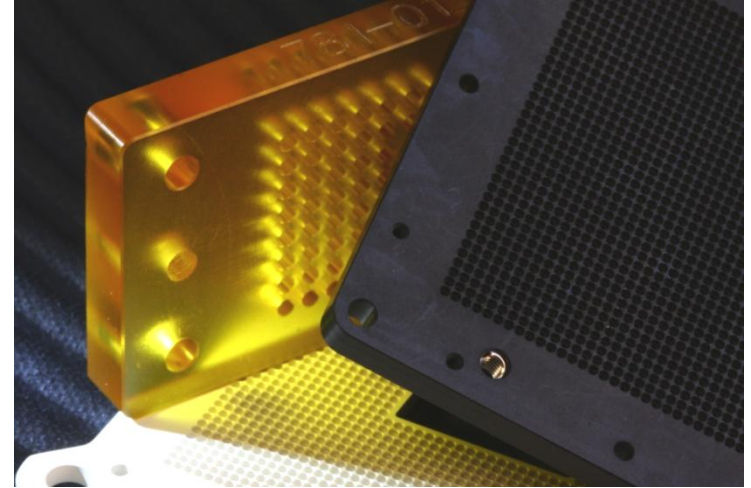
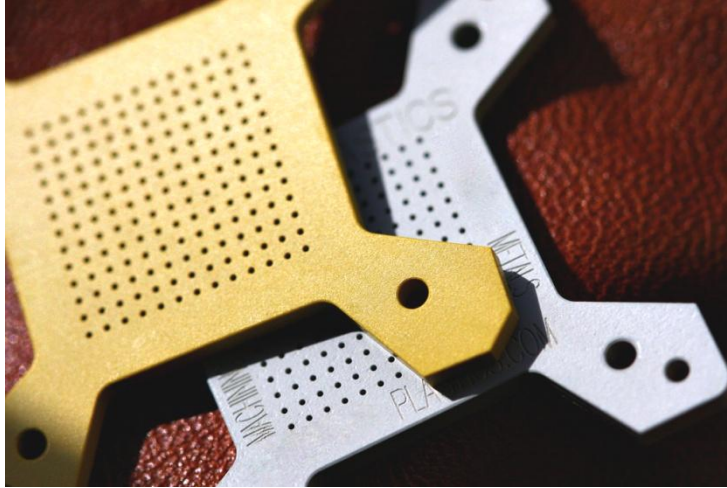
Increasing Melt Flow
with POSS[®] Masterbatch



Decreasing Extruder Torque
with POSS[®] Masterbatch

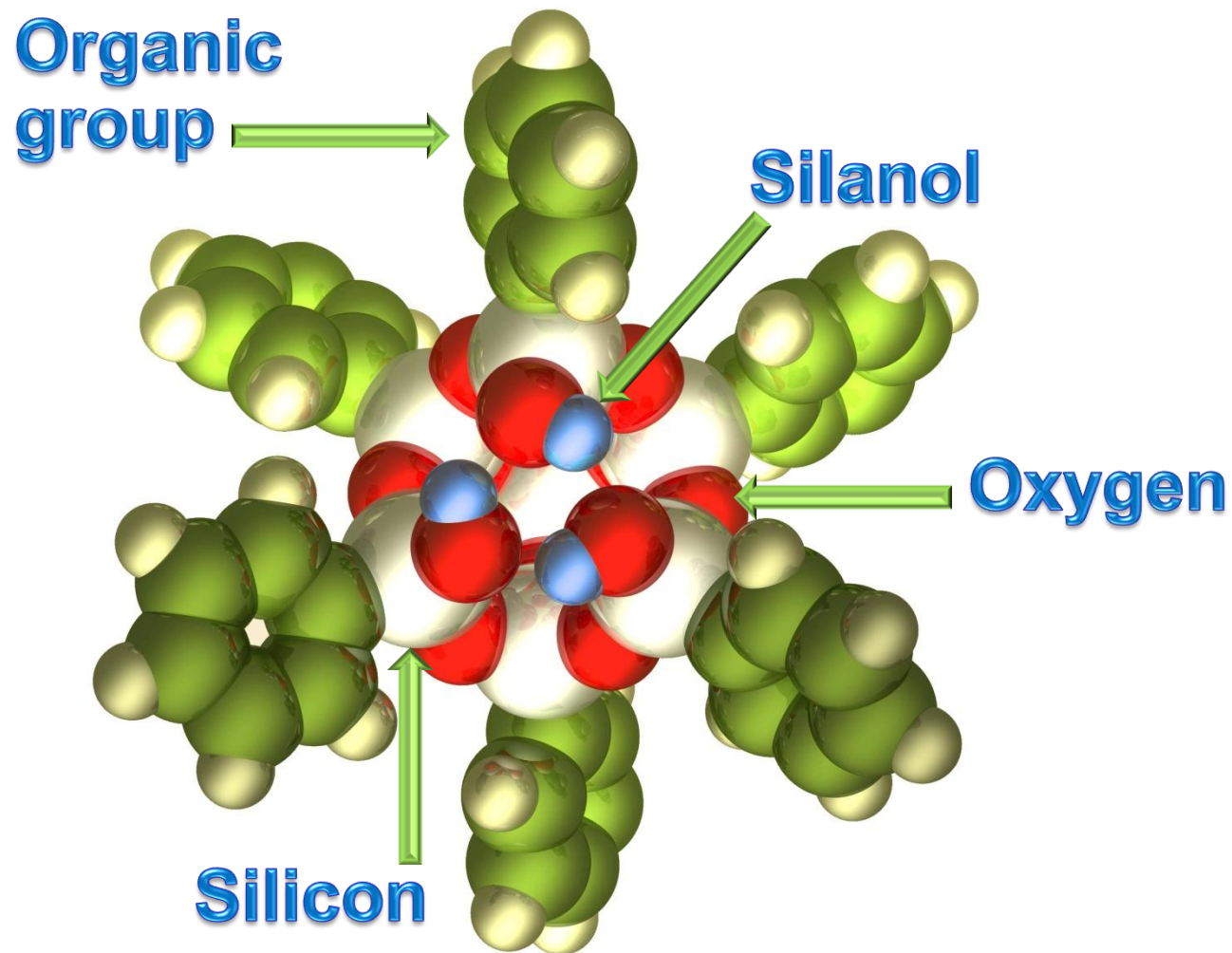


POSS® Flow Aids for Complex Parts

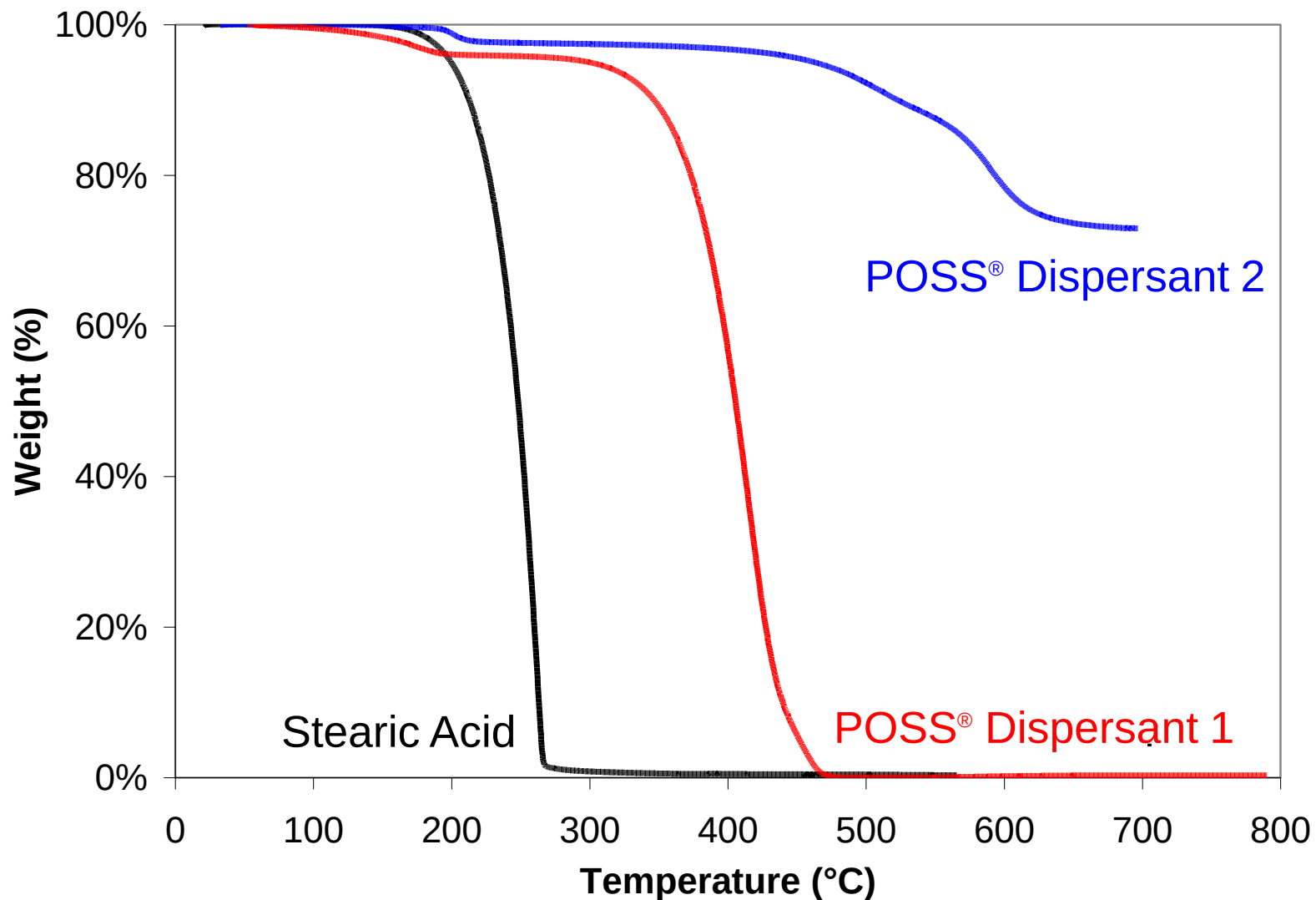


POSS[®] Dispersants

POSS[®] Trisilanol

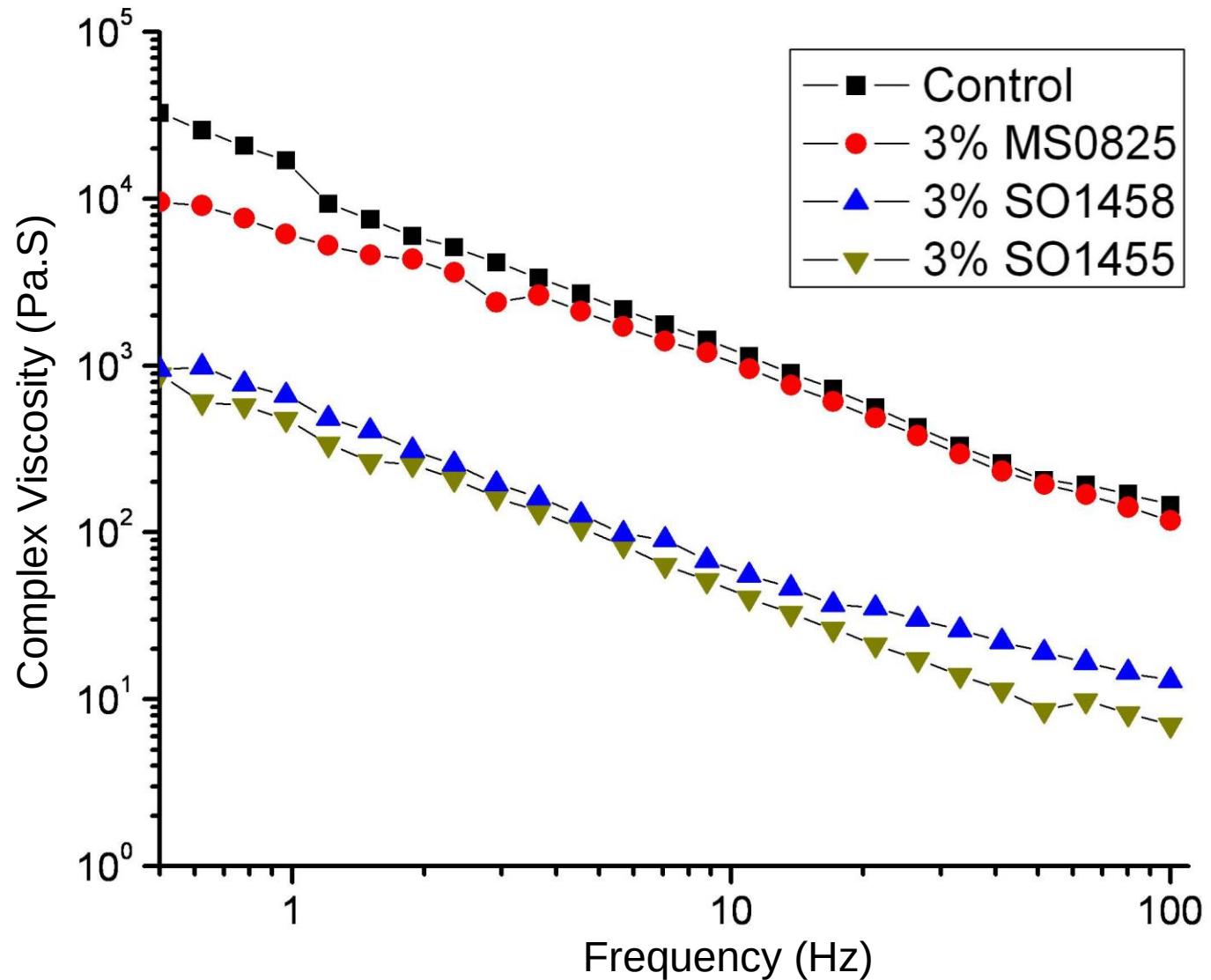


POSS[®] Dispersant Stability



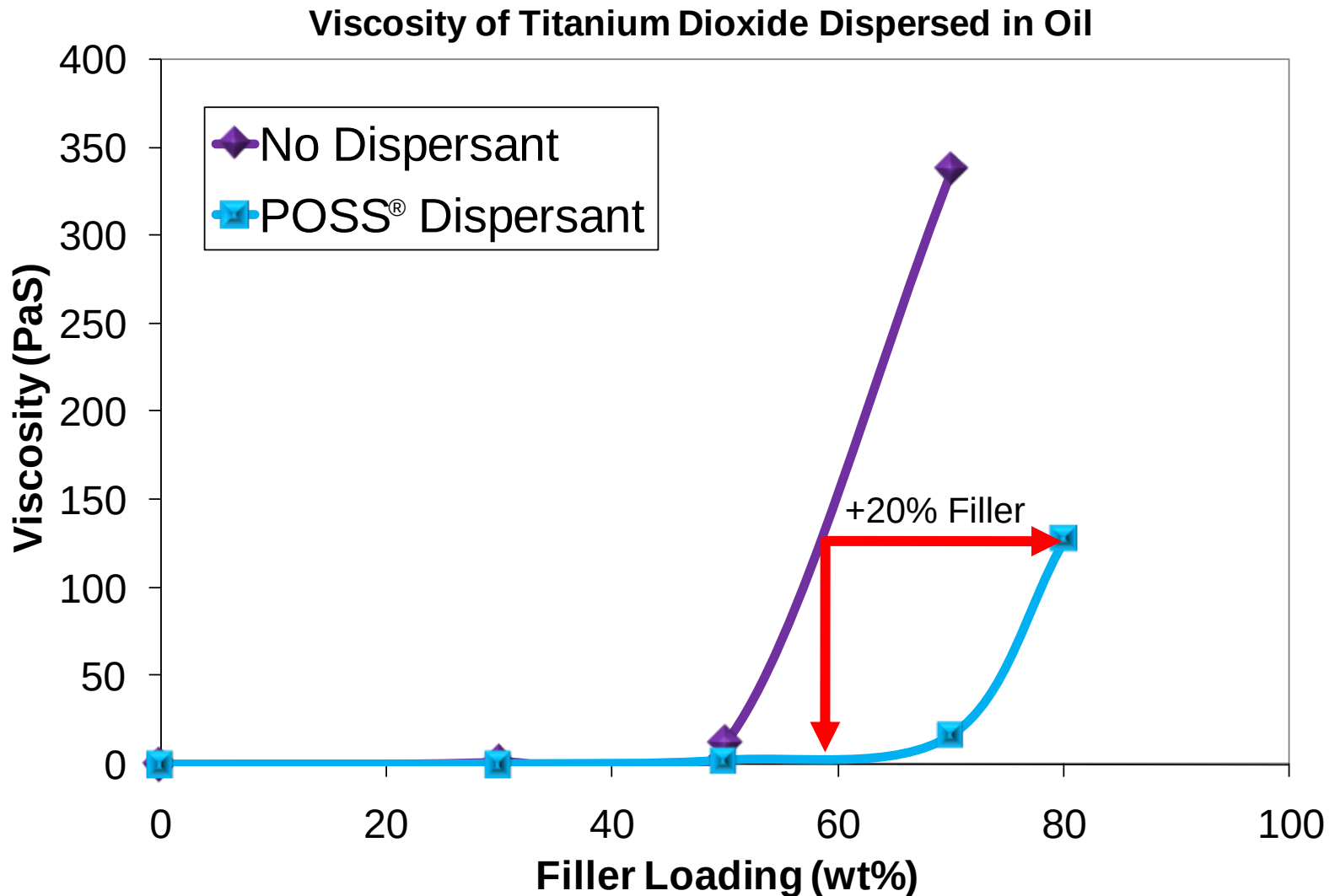
20°C / min under Nitrogen

POSS® Dispersants Reduce Viscosity



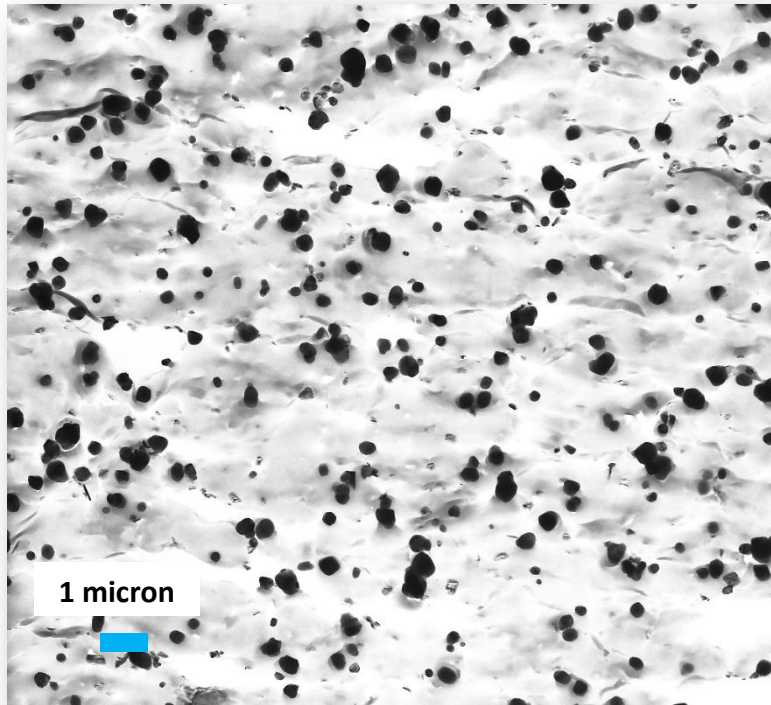
30% Hexagonal Boron Nitride in Squalane Cone-Plate

POSS[®] Dispersant allows Higher Loadings

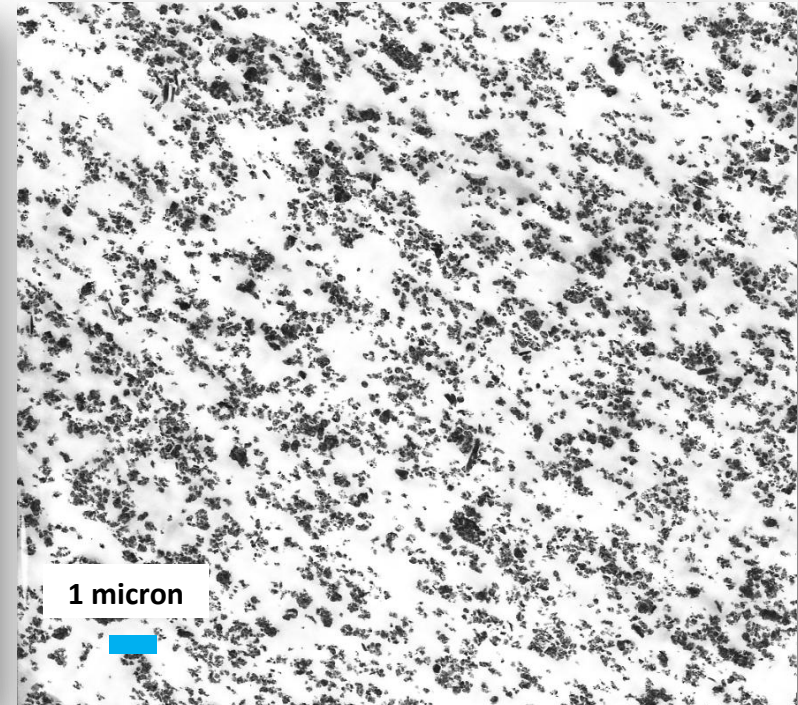


Viscosity @ 10sec⁻¹

TiO₂ with POSS[®] Dispersant in PEEK



TiO₂ in PEEK
no Dispersant



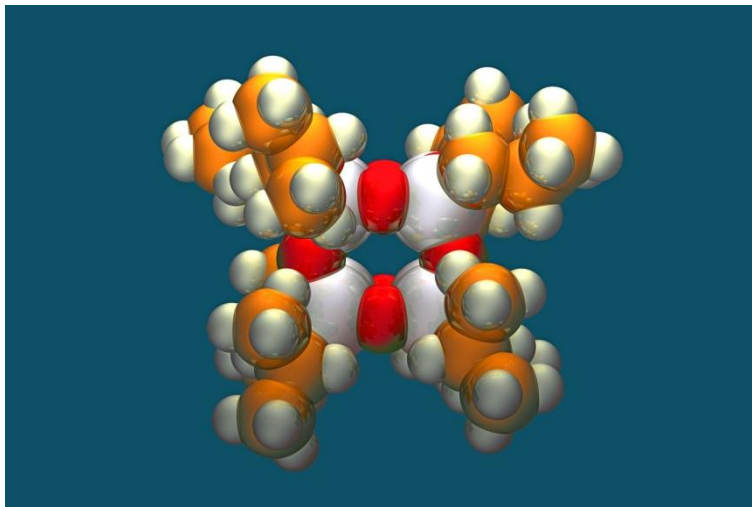
TiO₂ in PEEK
POSS[®] Dispersant

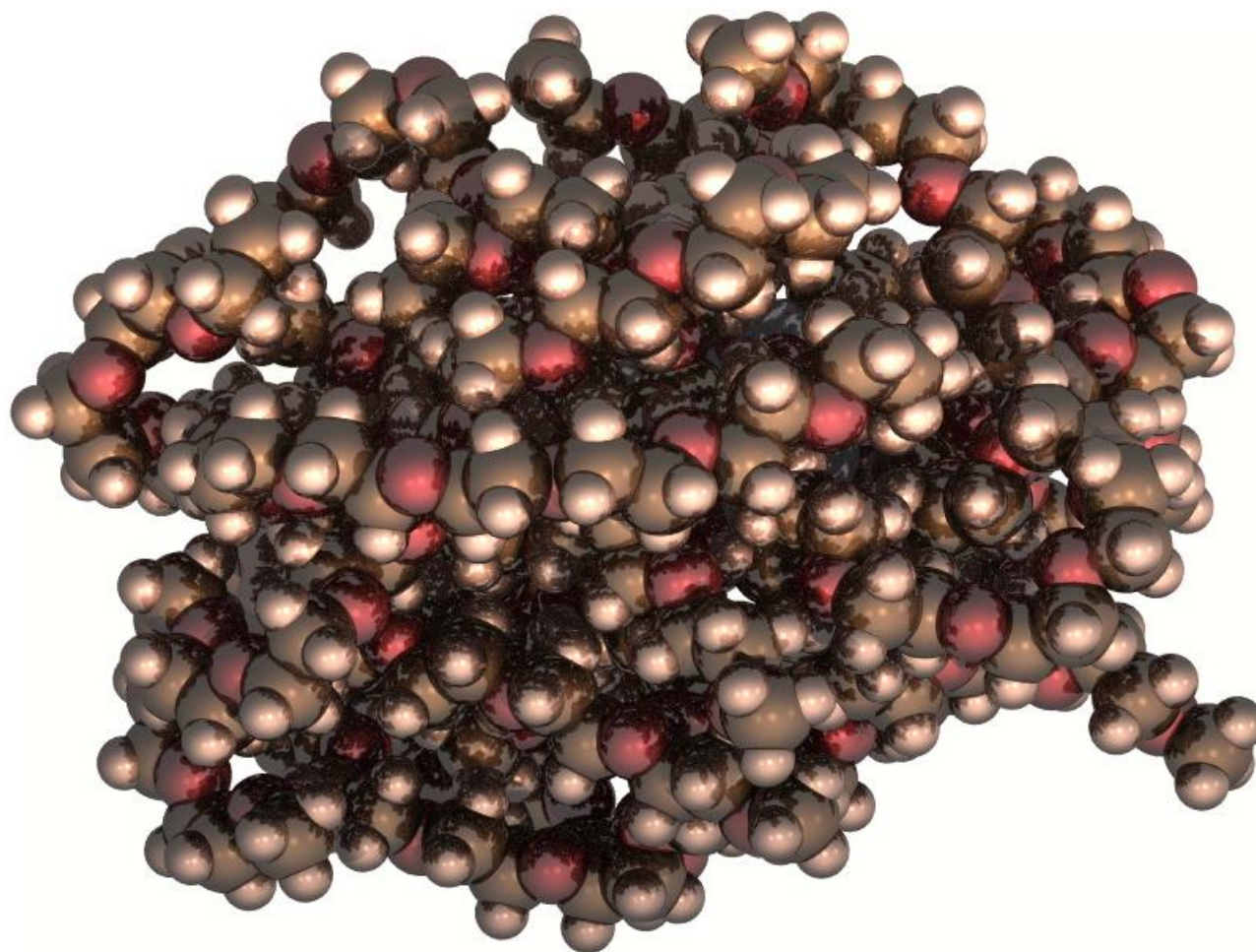
Why use POSS[®] Dispersants?

- Improve aesthetics, mechanical properties and processing
- Thermally stable
- Easy application
- Drop in, i.e. no pre-hydrolysis step
- No VOC
- Precise 1-2 nm coating
- Wide range of fillers:
titanium carbide, boron nitride, yttria, silica, titanium dioxide, calcium carbonate, mica, clay, wollastonite, iron oxides, titanium diboride, bismuth subcarbonate, metal particles etc...

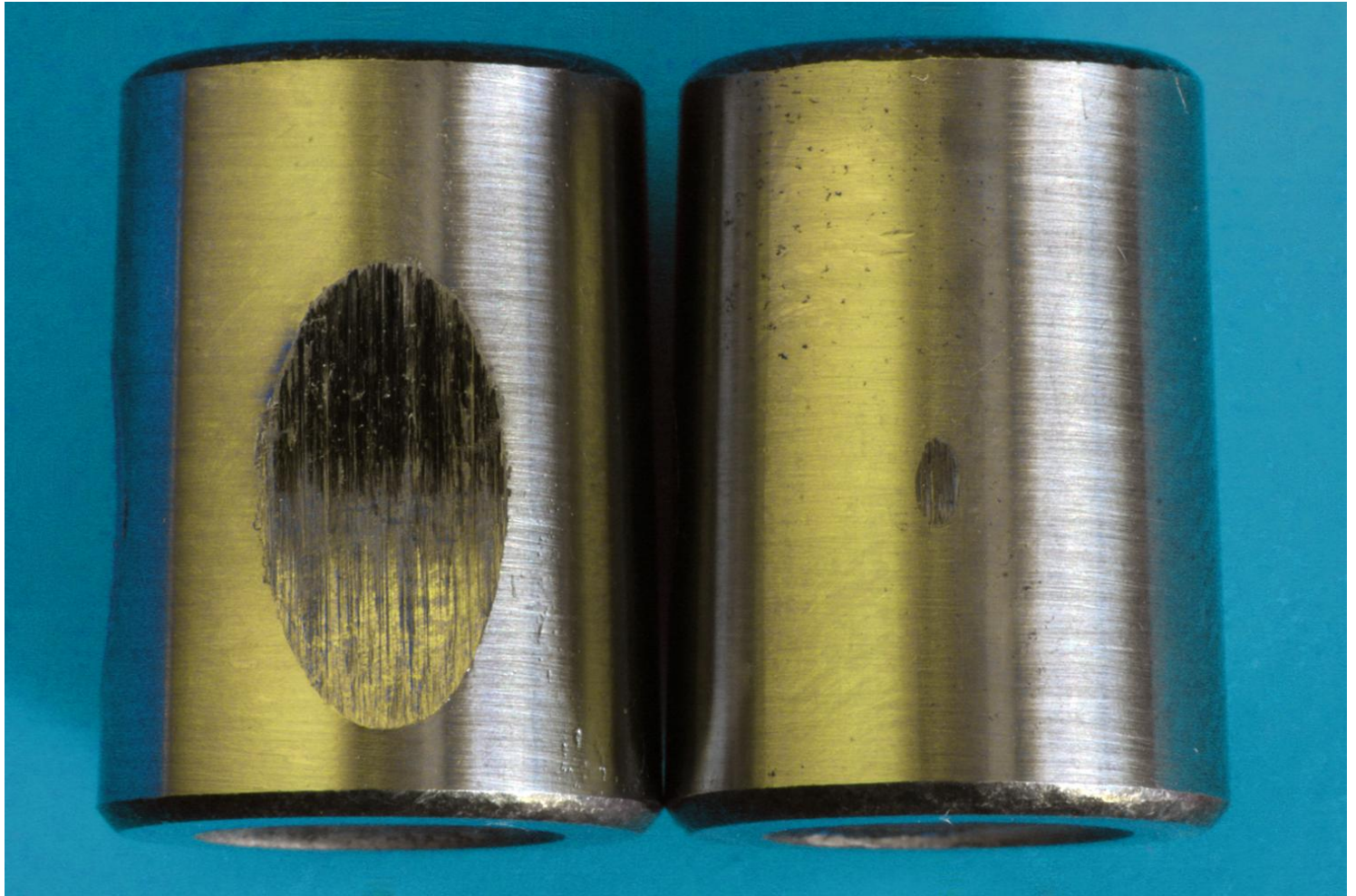
POSS[®] Lubricants

POSS[®] Lubricants





POSS[®] Lubricants



Standard bearing oil

100% PEG POSS[®]

Falex film strength tester 5kg load for 3 minutes

POSS[®] Lubricants

- High temperature stability 200-300°C
- Very low volatility
- Inert
- Safe
- Stable at high and low pH
- From non-polar to water-soluble
- Easily formulated



POSS[®] Production & Safety

Safety of POSS[®]

Several of the larger production volume POSS[®] types are TSCA listed

Octaisobutyl POSS[®] MS0825

US Category IV Oral LD50 > 5000 mg/kg

Octamethyl POSS[®] MS0830

EU Testing Oral LD50 > 2000 mg/kg

Dodecaphenyl POSS[®] MS0802

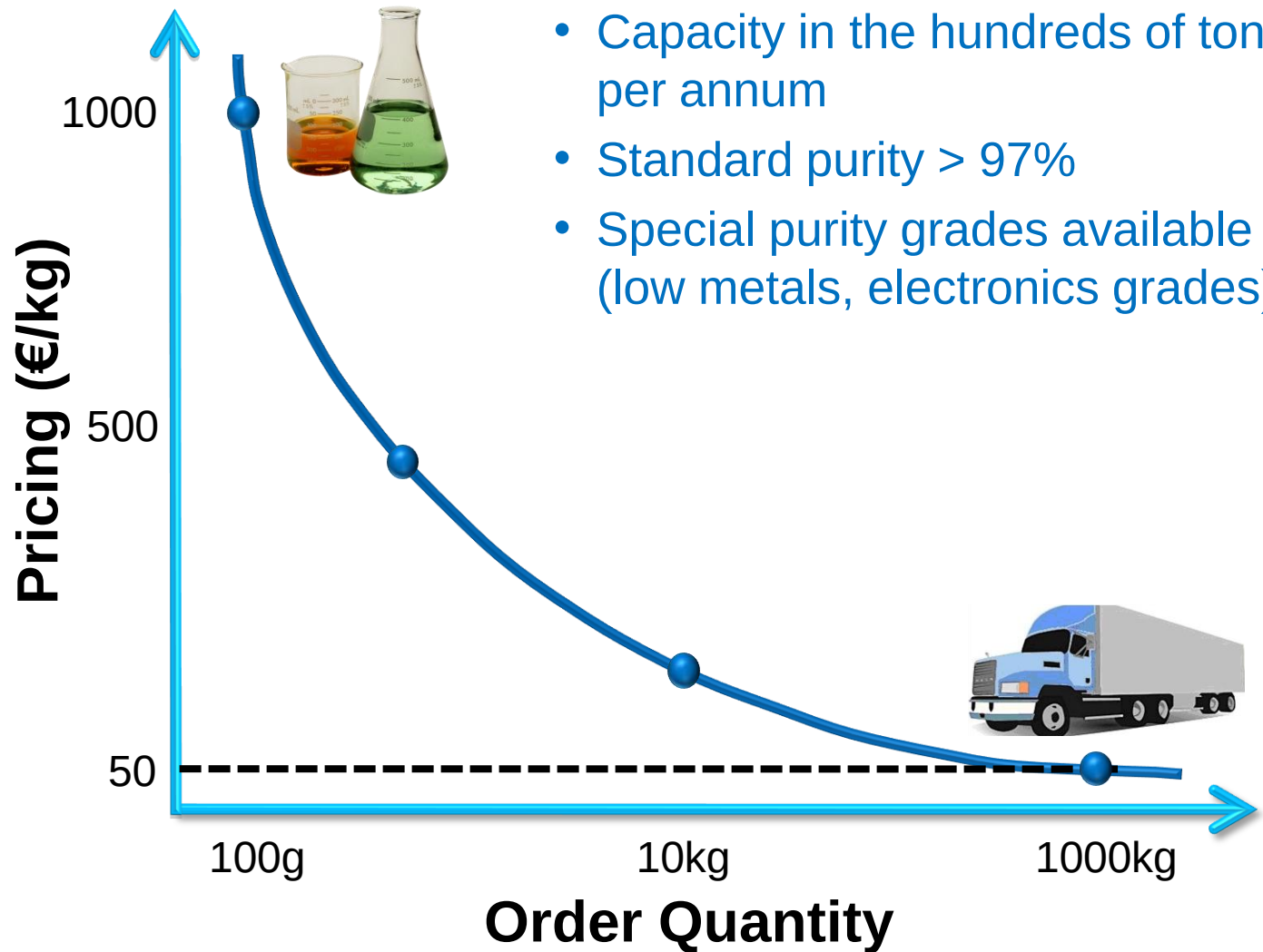
EU Testing Oral LD50 > 2000 mg/kg

Does **not** require the risk phrase R22 "Harmful if Swallowed"

Fish testing showed no toxicity

FDA food contact approvals underway

POSS[®] Pricing



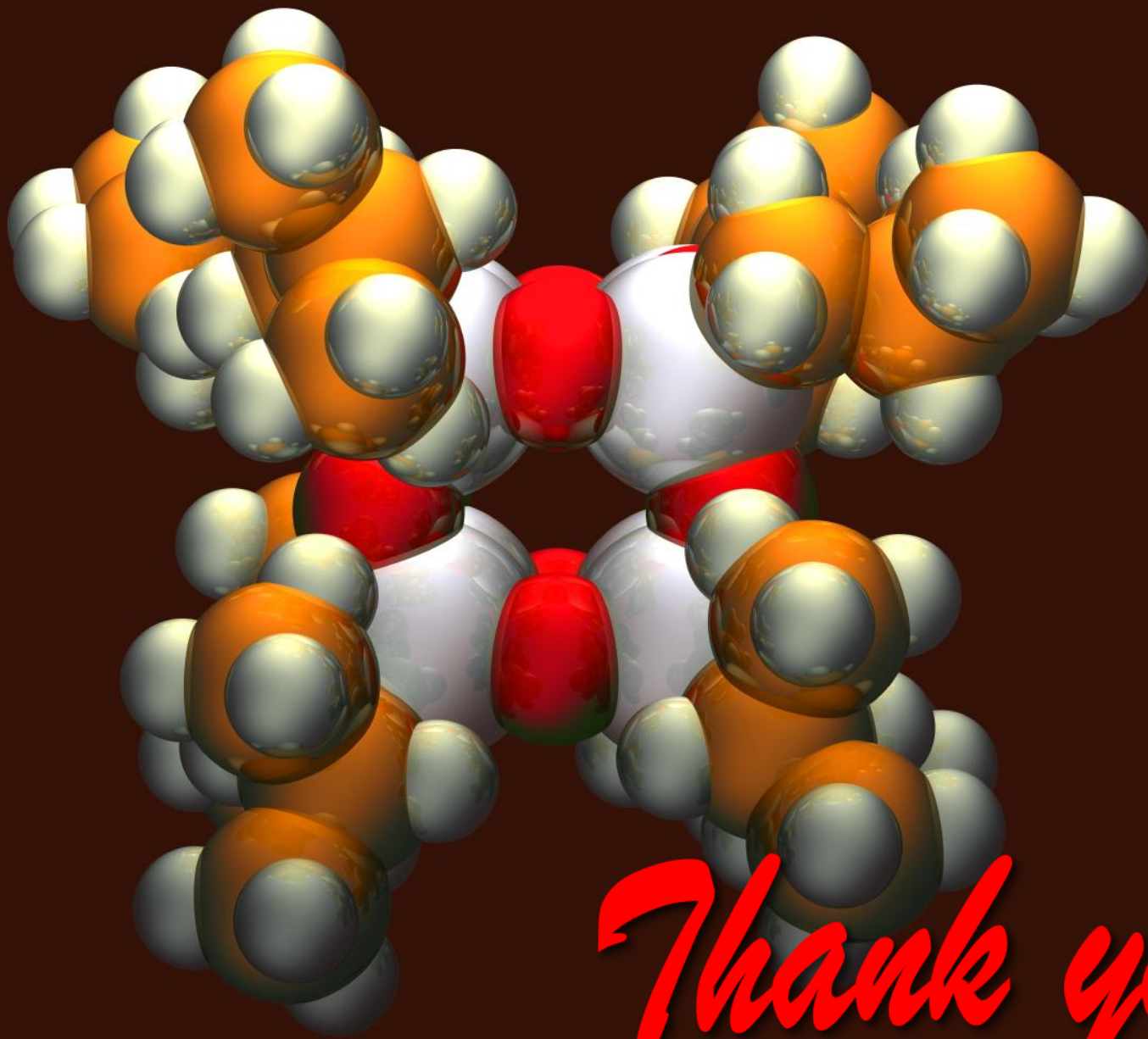
Hybrid Plastics Inc.



Summary

- POSS[®] additives available neat or in masterbatch concentrate
- The hybrid structure provides unique property combinations
- Hybrid Plastics works closely with customers to develop new products
- New POSS[®] applications and products arriving all the time





Thank you!