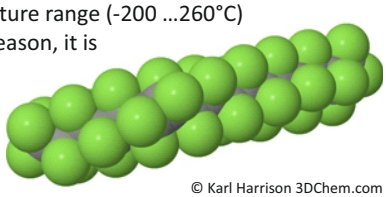
Leibniz-Institut
für Polymerforschung
Dresden

Chemically bonded PAI-PTFE anti-friction coatings for low-wear and low-maintenance tribological applications

State of the art

Because of its chemical structure, Polytetrafluoroethylen (PTFE) belongs to the group of high performance plastics. The material is chemically inert, antiadhesive, can be used in a wide temperature range (-200 ...260°C) and exhibits a very low friction coefficient (μ = 0.17/ 0.04 with oil). For that reason, it is widely utilized as a solid lubricant or anti-friction additive for many years. However, the polymer has some limiting drawbacks resulting in elevated wear or lack of processing and material stability.



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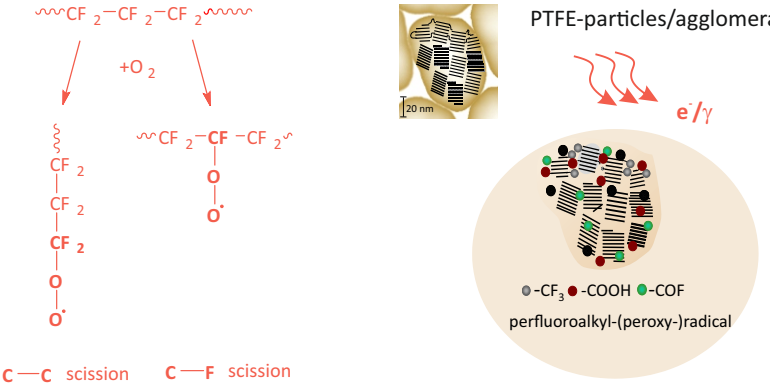
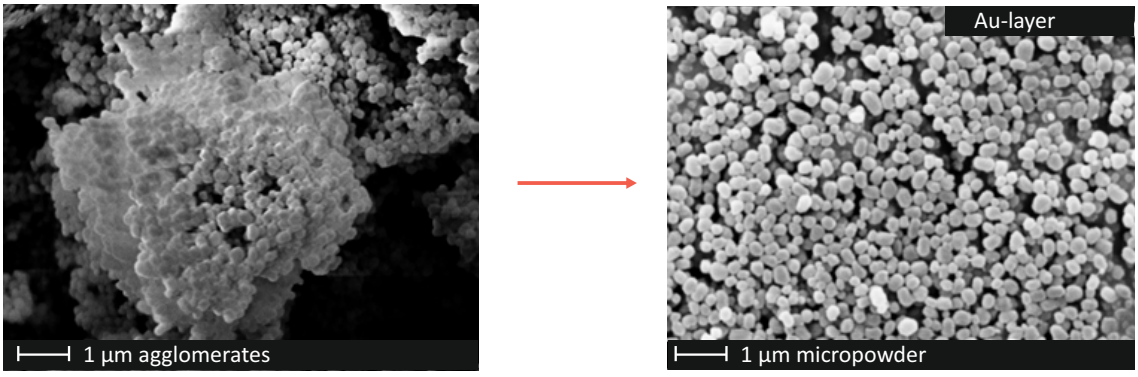
PTFE treatment by high-energy irradiation



Shortened mechanism to enhance the PTFE compatibility and for the generation of reactive groups as basis for chemical bonding with e.g. other polymers, oils and greases



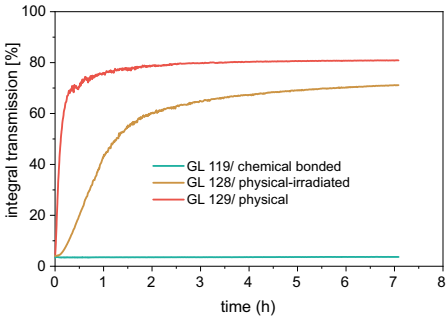
SEM-images of PTFE micropowder original (left)/ irradiated with 2000 kGy (right)

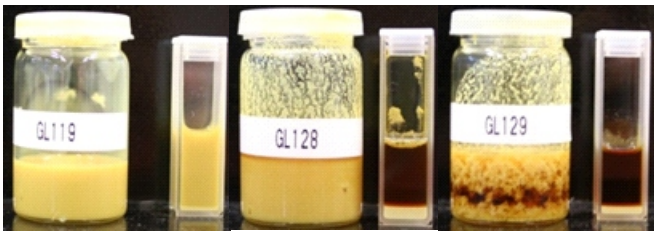
Properties of radiation modified PTFE-micropowder:

- lower molecular weight, melting temperature and melting viscosity
- generation of persistent radicals and reactive groups
- same broad application temperature and low friction coefficient

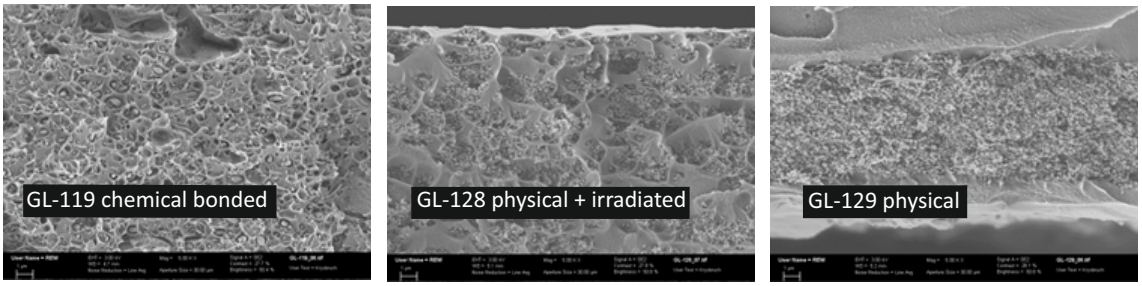
New material concepts for bulk materials, sliding lacquers and oils/ greases

Example:
Chemically bonded PAI-PTFE Sliding lacquers for low-wear and low-maintenance tribological applications

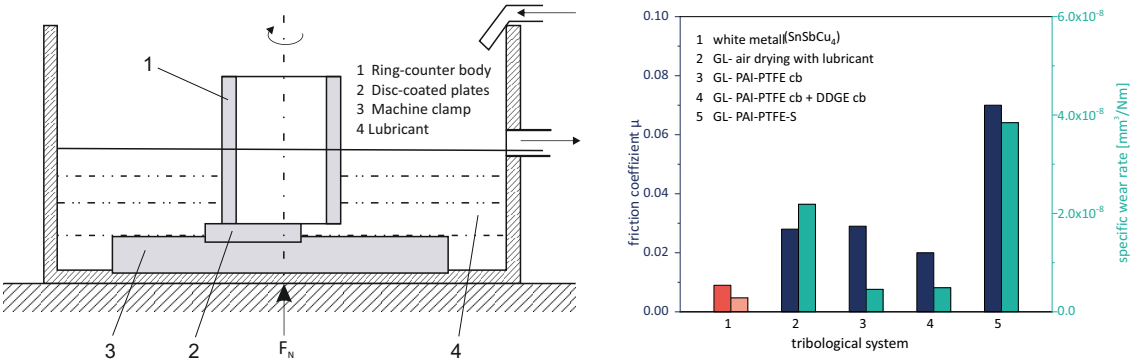




Dispersion stability of sliding lacquers at ~2300 g without additional dispersion additives



SEM-image of finally cured Sliding lacquer / cryo cut



Sliding layer for hydrodynamic sliding bearings as an alternative for white metal/ ring on disc tribometer (according to Siebel/Kehl)

Innovative advantages of PTFE chemical bonding

- reactive bonding of PTFE to e.g. polymers results in a drastic decrease of wear
- the friction coefficient value corresponds to origin PTFE
- drastic enhancement of long-term dispersion stability without additional additive
- optimal distribution and breaking down behavior of PTFE-particles
- improvement of bulk phase properties in comparison to physical mixtures

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