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DEVELOPMENT OF NEW-AGE PTFE NANOCOMPOSITES FOR TRIBOLOGICAL APPLICATIONS

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Summary

Polytetrafluoroethylene (PTFE) is widely used in tribology due to its low coefficient of friction, chemically inert nature, high thermal stability and self-lubrication behaviour. Nevertheless, the challenge with PTFE is the relatively poor wear resistance which are often improved by adding fillers. Thus, PTFE tribo-composites are commercially available with e.g. bronze, graphite or MoS2 fillers which can reduce the wear rate basically by one or two orders of magnitude. For further improvement it is required to understand the chemical background behind adding fillers and the potential tribo-chemical reactions during transfer layer formation.

The aim of this research work to develop alumina and/or functionalized graphene filled PTFE tribo-composites with ultra-low wear and low coefficient of friction simultaneously. The coefficient of friction can be reduced due to the so called ironing effect, where during the sliding motion the graphene layers align parallel to the sliding surfaces. In sliding motion the long PTFE chains undergo mechanical chain scission, and as a result of this chain scission carboxyl functional groups are formed on the PTFE chains. The hypothesis is that the formation and durability of the transfer layer, and in this way the wear resistance can be increased with these nanofillers which bear a large number of bonding sites to participate in chemical reactions with the carboxyl groups of in situ "functionalized" PTFE.