

A novel lubricant additive composing of protic ionic liquid and functionalized copper oxide nanoparticles

Triinu Taaber¹, Adam Erki Enok¹, Urmas Joost¹, Sven Oras¹, Kristjan Saal¹, Uno Mäeorg²,
Rünno Lõhmus¹

¹Institute of Physics, University of Tartu, Estonia; Estonian Nanotechnology Competence Centre

²Institute of Chemistry, University of Tartu, Estonia

E-mail: triinu.taaber@ut.ee

At the moment the development of lubricant is relevant because of the ongoing needs for reducing energy and material losses in mechanical devices. The aim of the present study was to investigate the applicability of protic ionic liquid and functionalized copper oxide nanoparticle composites as novel protective lubricant additive for metal wear parts. Either nanoparticles or ionic liquids independently have been shown to exhibit exceptional lubricating qualities [1,2]. A simple and an easy-to-modify synthesis method for the preparation of thiol-covered copper oxide particles was developed. A long process of optimization of reaction parameters was carried out that resulted in preparing non-agglomerated oil soluble copper particles with an estimated average diameter of 80 nanometer based on SEM measurements. Novel protic ionic liquid, which dissolves in oil was synthesized.

Lubricant tribological performance with the standardized four-ball-method was conducted with 15 kg. The combination of ionic liquid and nanoparticles significantly reduced the wear of materials. The addition of 1% ionic liquid and 0.5% copper oxide nanoparticles to base oil reduced the wear up 55% compared to base oil without any additives.

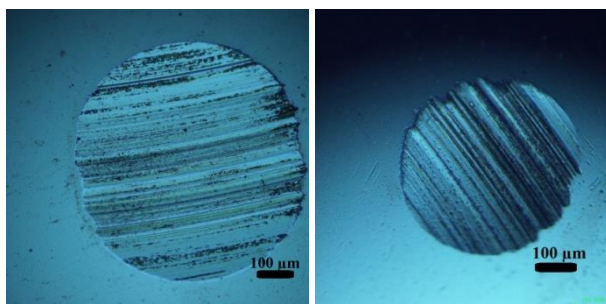


Fig. 1 Wear scar images of base oil (left) and base oil + 1% IL + 0.5% Cu (right).

References:

1. M.-D. Bermúdez, A.-E. Jiménez, J. Sanes, F.-J. Carrión, *Molecules*. **14**, 2888-2908 (2009).
2. V.N. Bakunin, A.Yu. Suslov, G.N. Kuzmina, O.P. Parenago. *J. Nanopart. Res.* **6**, 273–284 (2004).