Molybdenum disulfide based engine oil nanosuspensions with enhanced tribological and rheological properties

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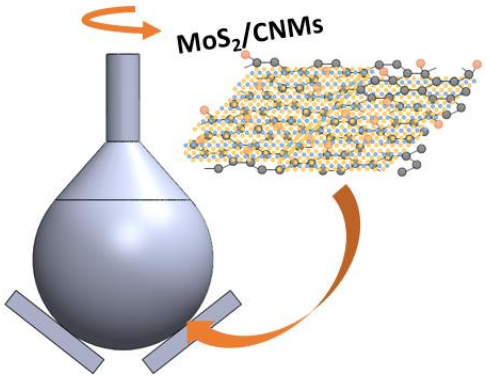
Keywords: molybdenum disulfide, carbon nanomaterials, nanotribology, rheological models

The development of new oil-based additives with excellent lubricant rheology, low friction factor, surface geometry, and low cost is crucial to produce more durable internal combustion engines with enhanced efficiency. Additives are primarily used to reduce friction, as well as to protect moving engine elements against wear, improve fuel economy and reduce pollution of gases emitted to the environment. Over the last few years, various types of nanoparticles have been tested for additives in engine oils. Molybdenum disulfide nanoparticles (MoS_2) deposited on carbon nanomaterials (CNMs) seem to be very promising material, due to their synergetic lubricating effect.

In this study, a novel, scalable, and facile method of the preparation of MoS_2 nanoparticles and the MoS_2 deposited on graphene oxide (GO), reduced graphene oxide (rGO), and carbon nanotubes (CNTs) with the use of an impinging jet reactor is presented [1],[2]. The use of the impinging jet reactor allows to easily control the process conditions and to obtain materials with desired and repeatable properties, including nanoparticles with a low tendency to agglomerate and a narrow size distribution [3]. Physicochemical analysis of the obtained MoS_2-based materials was conducted using various analytical techniques, such as: particle size distribution (PSD), X-ray diffraction (XRD), and scanning electron microscopy (SEM). The obtained materials were investigated as additives for 10W40 engine oil. The tribological behavior of the obtained nanosuspensions has been investigated using Mcr 302 rheometer from Anton Paar in a range of temperatures representing the operating conditions of the engines (i.e. -10 °C, 0 °C, 25 °C, 75 °C) and in a wide range of sliding velocity. The rheological properties have also been checked at the same temperatures. The results were compared to basic 10W40 oil and basic oil with the addition of reference MoS_2 nanoparticles from Sigma-Aldrich. The rheological models of the tested nanosuspensions have also been proposed.



The addition of the hybrid nanostructures obtained by the wet chemical synthesis in the impinging jet reactor improves the tribological and rheological behavior of the 10W40 oil at every temperature. Therefore the nanosuspension with MoS_2/CNMs can be used in typical car engines and advanced technologies with different operating parameters. This comprehensive analysis provides information for various industries not only for engine oils used in cars but also for more advanced technologies, such as aircraft turbines, turbocharged engines and many others.

Acknowledgments: This work was supported by the National Science Centre [No.2017/27/B/ST8/01382]

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