Introduction to the Ionic Liquids Special Issue

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Salts with melting points lower than 100 °C are called ionic liquids. Room-temperature ionic liquids possess melting points lower than room temperature. Ionic liquids are usually composed of an organic cation, typically containing nitrogen or phosphorus, and a weakly coordinating anion.

Ionic liquids based upon alkyl-3-methylimidazolium cations were first reported in 1982 by Wilkes et al. [1]. In 1992, Wilkes and Zaworotko [2] developed an air and water stable ionic liquid based upon the tetrafluoroborate anion. These water stable ionic liquids were the first ones selected as lubricants.

Ionic liquid tribology is a truly 21st century field of research, as it was effectively started in 2001 with the first article by Liu et al. [3]. Interest in these results has steadily increased the number of scientific articles to over 35 articles published each year on tribological aspects of ionic liquids, which reached 500 citations during the year 2009.

This special issue reflects the current status and universal interest of the field of ionic liquids in tribology, with articles from authors based in China, Europe, USA, Japan and Australia. The ionic liquids reported here contain those cations which have been most widely studied until now, alkylimidazolium, but also phosphonium and pyrrolidinium. The immense number of chemical formulations available is one of the main advantages of the research in ionic liquids as potential candidates to develop advanced, high-performance lubricants.

But ionic liquids are not only used as neat lubricants; the results reported here also cover interesting new aspects such as their applications as molecular lubricants in nanotechnology and their use as additives.

A critical issue in ionic liquid tribology is that of surface interactions, formation of adsorbed layers and tribocorrosion, which change with ionic liquids composition, sliding conditions, and contact materials. For obvious reasons, most studies on ionic liquid lubricants refer to steel–steel contacts. In this issue, other less commonly studied materials such as titanium alloys and ceramic coatings are also reported.

It is expected that the field of ionic liquid tribology will expand further in the future in such critical applications as high-pressure, extreme-temperature and high-vacuum conditions, as lubricants or lubricant additives and in contacts with such difficult-to-lubricate systems as light alloys and nanodevices.

As guest editor, I am most grateful to the editors of Tribology Letters for their invitation and to the authors which have kindly accepted the invitation to submit articles to this special issue.

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