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# Study on the conductive and tribological properties of copper sliding electrical contacts lubricated by ionic liquids

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**Abstract:** To reduce energy dissipation, improve reliability and lifetime of sliding electrical contact, ionic liquids (ILs) and multiply-alkylated cyclopentanes (MACs) were employed to lubricate copper sliding electrical contacts. Their physical properties, electrical contact resistance (ECR) and tribological properties were investigated in detail. Standard deviation was introduced to evaluate the stability of conductive and tribological behaviors. Results show that ILs not only greatly lower the COF, ECR and wear volumes, but also make them more stable as compared with MACs. Based on the characterization and analysis of the lubricants and worn surfaces, the conductive and tribological behaviors of different lubricants under current-carrying friction are related to the nature of the lubricants and the protective film generated on the worn surfaces.

**Keywords:** Sliding electrical contact; Ionic liquids; Electrical contact resistance; Tribology

## 1 Introduction

Nowadays, with the development of the electrification engineering, the number of sliding electrical connectors has increased dramatically [1]. Sliding electrical connector is known as the key element appearing in electromechanical equipment, such as electrical switch, high-speed railway and power transmission system and so forth, which performs the main functions of connecting, breaking and transmitting electrical energy or signal [2-3]. The performances of the sliding electrical connector have a critical influence on the reliability and lifetime of operating system and much work has been done in this field. In the past decades, the research is mainly focused on dealing with the sliding electrical contact materials to improve the conductive and tribological properties [4-6]. Although a series of metal-based self-lubricating materials are intensively studies, these problems are still exist [4-7].

Lubricants have been widely employed to reduce both friction and wear in industrial fields. However, different from the conventional operating conditions, when lubricants are applied in electromechanical equipment, some specific requirements are imposed. Besides excellent lubricity,

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