Effect of Surface Roughness on Improved Lubricity under Ironing Condition Using a Synthetic Mica-Organic Intercalation Compound

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Abstract

It is well known that the surface roughness of metal substrates considerably influences the tribological properties of solid lubricants. In this study, the surfaces of metal substrates were modified by wet-blasting and polishing, and the lubrication performance of synthetic mica-organic intercalation compounds on these substrates was evaluated using an upsetting-ironing type tribometer. Wet-blasted substrates lubricated with synthetic mica exhibited the best anti-seizure ability, whereas a lubricated polished metal surface produced the worst results. Scanning electron microscopy (SEM) and energy dispersive X-ray spectrometry (EDS) revealed that concavities prepared by wet-blasting still remained on the ironed substrate surface, and the intercalated synthetic mica trapped in concavities was supplied to the flat areas as ironing advanced across the substrate surface. Furthermore, EDS and Fourier-transform infrared spectroscopy (FTIR) analysis showed that intercalated synthetic mica extended on the ironed surface while releasing organic compounds from its interlayer spaces. As the ironing process continued to progress, the initial concavities gradually became shallow, but they did not completely flatten. Therefore, a roughened surface is more advantageous for achieving improved lubricity due to the continuous supply of solid lubricant from concavities to the flattened areas where seizure is likely to take place.

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