The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM)
ISSN: 2602-3199

The Eurasia Proceedings of Science, Technology, Engineering and Mathematics (EPSTEM), 2025

Volume 34, Pages XXX-XXX

ICBASET 2025: International Conference on Basic Sciences, Engineering and Technology

Tribological Behavior of Chromized and Doped Chromized Coatings on 430 Stainless Steel Under Varying Loads: Addressing Wear Issues in Industrial Applications

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Abstract: In this study, chromized and doped-chromized coatings on 430 stainless steel substrates were tested under various friction conditions (2N, 6N, and 12N) to investigate the effect of doping on surface properties and tribological behavior. The microstructure, roughness and tribological properties of different coatings were investigated and compared. The results showed that doping the chromized coating with magnesium significantly improved the surface roughness by about 36 %, reducing it from 0.4002 µm to 0.2559 µm. Additionally, the doping treatment can significantly enhance tribological behavior by decreasing the friction coefficient. For a load of 2N, the coefficient of friction decreased from 0.21 µ for the chromized coating to 0.03 µ for the doped coating. Under a load of 6N and 12N, it decreased from 0.35 µ and 0.38 µ for the chromized coating to 0.12 µ and 0.28 µ, respectively for the doped-chromized coating. Cracks, delamination, oxidation, and fractured areas were observed in the chromized coating, whereas cracks and plastic deformation were observed in the doped coating. These results demonstrate the potential of magnesium doping to enhance the performance and durability of chromized coatings deposited on 430 stainless steel under various friction conditions.

Keywords: Tribological behavior, Chromized coating, Doped-chromized, Magnesium doping, Friction coefficient.