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Scientific line:

Lubrication in Forging

Title: High temperature hot forming

Company: Northwestern Polytechnical University

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Long Wang, PhD, he obtained PhD degree under the supervision of Senior Prof. Anh Kiet Tieu from University of Wollongong (Australia), now is a prospective professor in Northwestern Polytechnical University. His research interest is High temperature lubrication and Protection, including lubricants for hot metal forming (hot forging, rolling, extrusion). Now, he has published more than 60 SCI papers related to materials and tribology, wear and lubrication; Applied for 15 invention patents; Serving as a young editorial board member for international academic journals such as the Journal of Tribology, Chinese Journal of Surface Engineering, Chinese Journal of Mechanical Engineering, International Journal of Extreme Manufacturing, and guest editor for special issues such as Lubricants, Coatings, etc.

Abstract:

In the field of high-temperature hot forming processing, lubrication is an effective way to improve the surface quality of workpieces and extend the life of grinding tools. In the process of hot forming (hot forging), glass is one of the commonly used lubricants in industry, its performance is highly related to the type of workpiece. The relationship between glass content, lubrication performance and tribo-interface is not clear. The authors attempt to establish the relationship of glass, physical-chemical properties and lubricating performance. The authors found that glass based lubricating materials with appropriate Zr content contribute to the improvement of lubrication performance. This is mainly due to appropriate high temperature wetting, the multi-layered structure of the friction interface and the easily shearable melt layer. The surface layer is an amorphous melt containing Fe_2O_3 and Cr_2O_3, the bottom layer is a Cr_2O_3 layer diffused from the substrate, and the middle layer is an amorphous glass layer. Fe_2O_3 dendritic particles and iron oxide epitaxial growth are present on Cr_2O_3 and $FeCr_2O_4$ spinel, which improves the bearing capacity of the lubricating material. At the same time, it was found that the lubrication performance of glass is not only related to viscosity, but also to high-temperature wetting, which is crucial. High temperature wetting and lubrication can be achieved through the regulation of material composition structure, thereby realizing the integration of high-temperature oxidation resistance and lubrication.