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A new generation of MoS2/Ti-based solid lubricant coatings

Xiaoling Zhang[1], Kevin Cooke[1], Xiaoying Li[2]

[1]Teer Coatings Ltd, Miba Coating Group, Droitwich, Worcestershire, United Kingdom [2] School of Metallurgy and Materials, University of Birmingham, Birmingham, United Kingdom

xiaoling.zhang@miba.com

Thanks to the progress achieved over the last two decades, the applications of MoS_2 -based solid lubricant coatings have been extended from dry and vacuum conditions to ambient environments. MoST® (MoS_2/Ti-based) coatings have been the most commercially successful examples. However, obstacles still exist for the wider application of the MoS_2-based solid lubricant coatings; for example, their maximum practical thickness is normally restricted to ~1.0 µm (beyond which coating wear accelerates dramatically). MoST/MoST+TiB_2 nano-scale multilayer coatings deposited by closed field unbalanced magnetron sputter ion plating (CFUBMSIP) are a new generation of the MoST® coatings. The coefficient of sliding friction of the New-MoST® coating is 0.02-0.05 (compared with 0.02-0.1 for current MoST® coatings). The thickness of the New-MoST® coatings can be increased to as much as 4.0 µm if required, while the specific wear rate and the load bearing capacity of the coatings can be maintained at the similar values (1.0×10^{-17} m^3 N^{-1} m^{-1} and 5.0 GPa respectively) to those of the thinner 1.0 µm coating. Consequently, the possibility of a thicker New-MoST coating provides an opportunity for longer wear life. The coatings have been characterised by XRD, SEM and TEM analyses and it has been found that the optimized multilayer New-MoST® is built up with two to four basal-oriented MoST monolayers sandwiched between Ti and TiB_2 nano-layers. It is expected that the applications of the MoS_2/Ti-based coatings will be further extended not only for forming and cutting tools, but also for new applications with requirements of low friction, high load bearing capacity, long endurance and reliability.

Keywords
MoS2-based coating
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MoST coating
Solid lubricant coating
Coating thickness