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Research Article

Influence of single phase NiS nanoparticles as lubricant additive in microscale deformation of copper gear

S Nanthakumar  & D Thangaraju 

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ABSTRACT

Demand for miniature gears is increasing daily due to huge development in MEMS and microdevices. As a result of this drive towards miniaturisation, microsystem technologies are becoming increasingly important. In this concern, researchers are interested in developing a micro forming process to manufacture highly accurate micro gears, improved operational and functional characteristics, capacity to perform in hazardous environmental conditions, and longer service life. Single-phase NiS nanospheres were developed using a high-temperature wet chemical method and were dispersed in engine oil (SAE 20 W-40) for further forming process. During plastic deformation (micro-scale), the combined grain size effects and NiS nanoparticle added lubricant on formability and interfacial friction of the micro gear are investigated. The grain size effect significantly impacts the micro gear's formability during micro forming. The grain size and orientation significantly influence the microscale deformation process. Due to the size effect, the microhardness value at the centre and the tooth varies considerably. Due to the existence of NiS nano additive lubricant, the surface quality of micro gear improved significantly. The findings of this work help to comprehend the properties of nano additive lubricant and how it behaves tribologically throughout the micro-forming process.