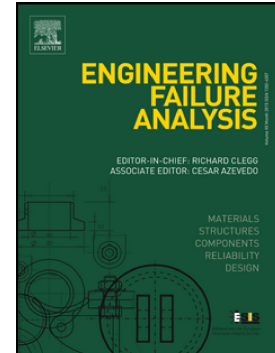


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Influence of cu nanofluids on the rolling contact fatigue life of bearing steel

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Influence of Cu nanofluids on the rolling contact fatigue life of bearing steel.**Prashant Thapliyal**^{a,1}^aAsst. ProfessorArmy Cadet College, Indian Military Academy, Dehradun and
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²E-mail:gdthakre@iip.res.in**Abstract:**

Rolling contact fatigue (RCF) tests were conducted on AISI E-52100 steel balls lubricated with Cu nanofluids prepared using SAE 5W-40 synthetic oils as base fluids. Functionalized Cu nanoparticles were blended to 0.2% by weight concentration in the base fluids obtained from two different manufacturers. The RCF tests were performed on four ball rolling contact fatigue tester at 75°C, maximum Hertz stress of 7.37 GPa and a speed of 3000 rpm. The bearing balls tested with Cu nanofluids showed an enhancement of L_{10} life by 61% as compared to the base fluid. Investigations have also been performed to determine the physicochemical properties of the lubricant blends and their tribo-performance behavior. The tribo-performance of lubricant blends has been investigated using four ball wear tester. The studies have revealed that blending of Cu nanoparticles does not significantly enhance the tribo-performance of blended lubricants. However, the use of nanofluids significantly enhances the fatigue life of the lubricated contacts. The SEM and EDX analysis reveal that the severity of surface damage decreases with the use of nanofluids.

Keywords: Nano-fluid, Tribology, Multigrade lubricant, Cu nanoparticles, Rolling Contact Fatigue, Weibull analysis.

1. Introduction

Nanofluids have gained significant popularity among the research community since the term was coined by Choi in 1995 [1]. Nanofluids are in general synthesized by dispersing nano-sized particles of elements/compounds in the base fluids in varying concentrations to either enhance or suppress the desired and/or undesired properties of base fluids. Nanofluids for lubrication application generally use mineral oil (Hydrocarbon), water, ethylene/propylene glycol, esters, PAOs etc as base fluids. On the basis of chemical functionality, the nanoparticles are grafted, functionalized or treated with dispersants to achieve stable and long lasting dispersion of nanoparticles in base fluids. Over the years, the metallic nanoparticles of Cu, Ni, Fe, Co etc. have been extensively studied for their use in the development of nanofluids [2 – 4].

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