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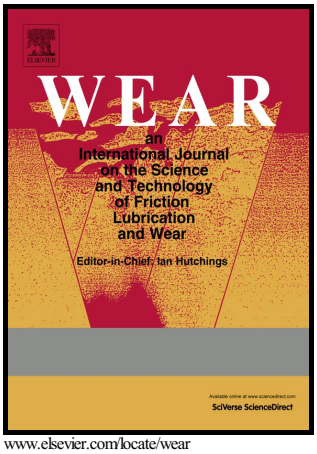

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Debris trapping and space-varying contact via surface texturing for enhanced noise performance

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Abstract:

In this work, groove-textured surfaces with a certain widths and pitches are manufactured on flat cast iron samples. Whereafter, another material (aluminium and steel, respectively) is filled into the grooves to form a special surface which possesses space-varying properties. These surface-treated specimens are tested in a ball-on-flat system and the ensuring friction-induced vibration and noise are measured. The ball sample used in the test is chromium bearing steel ball (AISI 52100). It is found that adding aluminium material into the grooves will increase the friction-induced vibration and noise level of friction system. Conversely, adding steel material into the grooves can stabilize the friction system. Moreover, this space-varying contact state surface is valuable to study the relationship between the trapping wear debris behaviour and stability of texturing surface, which validates our previous speculation that wear debris accumulation on the contact surface will deteriorate the friction-induced vibration and noise behaviour of friction system, and the capability of grooves in trapping wear debris is beneficial for reduction of vibration and noise. Numerical simulation is performed to give reasonable explanations for the experimental phenomenon. This investigation suggests that friction surfaces with grooves filled with suitable materials are able to reduce friction-induced vibration and noise.

Key words: Space-varying surface property; groove-textured surface; friction-induced vibration and noise; friction; wear; wear debris.

1. Introduction

Friction-induced vibration and noise (FIVN) arising from mechanical applications which contain sliding frictional contact is commonplace [1-4]. The FIVN phenomenon in most cases