Micropitting and Fatigue Measurement of Thermoplastic Materials

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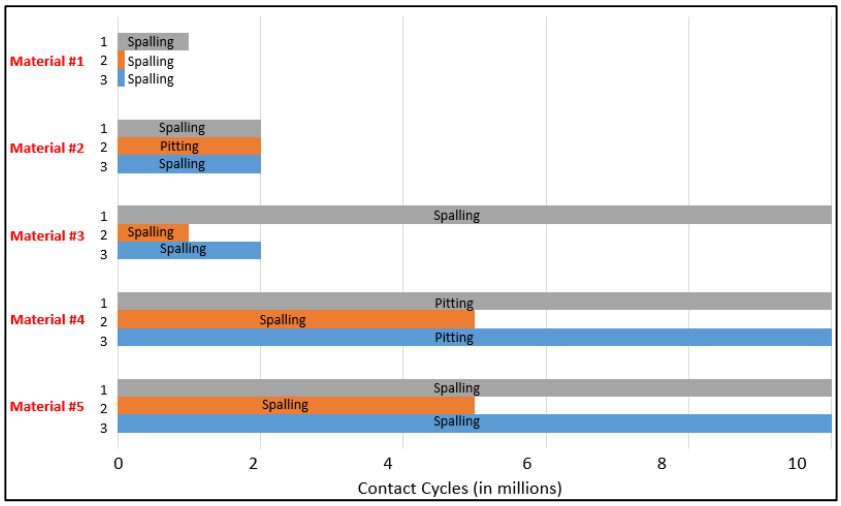
MOTIVATION:

Micropitting is a surface fatigue failure mode common in cyclically loaded contacts such as in rolling element bearings and gears. In addition to being a failure mechanism in itself, micropitting can cause the occurrence of other failure modes such as surface-initiated spalling. The scientific objective of this work is to study the onset and progression of micropitting and fatigue life of relevant thermoplastics. When compared with metals, thermoplastics have lower frictional properties, less wear, higher corrosion resistance, and are thermally and electrically insulating.

MATERIALS & METHODS: Three fatigue tests were performed at 100^0C and 10N load on each of five different thermoplastic materials on a micropitting rig (MPR). Post-test analysis included visual inspection of MPR rollers and optical interferometry to track surface metrics.



RESULTS: The results of the testing are shown in the figure on the left. Spalling indicates that the sizes of material removal in the contact area was greater than 10 micrometers, while Pitting refers to material removal less than 10 micrometers.

CONCLUSIONS: Thermoplastic rollers with smoother surfaces generally achieved longer fatigue lifetimes under the conditions tested on the MPR. Results from finite element analysis (FEA) were used to validate the tested fatigue life of the relevant thermoplastics, in addition to predicting contact pressure distribution and contact patch sizes.

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