

INFLUENCE OF A NON-SULPHONATED DETERGENT ON ANTIWEAR FILMS FORMED FROM ZDDP ON AN AL-SI ALLOY: A XANES STUDY

*Gavin Pereira^a, Andreas Lachenwitzer^a, Masoud Kasrai^a, Peter R. Norton^a,
Bradley H. Frazer^b, Gelsomina De Stasio^{b, c}*

^a *Department of Chemistry, The University of Western Ontario, London, Ontario, N6A 5B7,
Canada*

^b *Synchrotron Radiation Center, University of Wisconsin-Madison, Stoughton WI 53706*

^c *Department of Physics, University of Wisconsin-Madison, Madison WI 53589*

The influence of a non-sulphonated detergent additive (Ca-phenate) on the chemical properties of antiwear films generated from base oil with the antiwear additive, zinc-dialkyl-dithiophosphates (ZDDPs) on a die-cast Al-Si alloy has been investigated using X-ray Absorption Near Edge Structure (XANES) and nanomechanical measurements. The tribochemical films were prepared using a Plint high frequency wear tester. The antiwear films were generated under various conditions such as contact temperature, rubbing time, and additive concentrations. The chemical composition of the antiwear species that were formed were found to be typically shorter chained polyphosphates, which can be semi-quantitatively derived from the P L-edge XANES spectra from peak intensity and peak fitting. The relative film thickness was measured using the P K-edge XANES. The mechanical properties of the antiwear pads, which are believed to be important parameters that determine the quality of the antiwear behavior, are addressed by nanoindentation measurements. The antiwear behavior was estimated by recording coefficient of friction and evaluating the wear.