

Understanding the *In-Situ* Formation and Evolution of Phosphorus Antiwear Tribofilms with FFM and NanoIR-AFM

CATEGORY OR KEYWORDS

Tribochemistry

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INTRODUCTION

In vehicle transmissions, antiwear tribofilms form from lubricating fluids on rolling / sliding contacting surfaces and serve to control friction and protect surfaces from wear and fatigue. Understanding the mechanism of antiwear film formation and how to tune surface chemistry to control functionality is essential for development of next generation transmission fluids. Here, we developed a unique multimodal AFM methodology to understand initial film formation from different phosphorus-containing lubricants *in-situ*. We combined Friction Force Microscopy (FFM) to capture the spatial details of friction over the surface as the tribofilm forms and evolves and Nano Infrared Spectroscopy AFM (NanoIR-AFM) to understand the chemistry of the film. We demonstrate the formation of antiwear tribofilms on steel surfaces, the effect of lubricant formulation on how these films evolve *in-situ*, and the differences in chemistry between these films.

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