No. 24A27

Taiho Kogyo Tribology Research Foundation

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Theme: In-situ identification strategy for additive-derived tribofilms on coating surfaces

Related Presentation/Publication

Past Oral presentation in ECOTRIB 2025.
Title: Wear Monitoring via a Raman-Based Bilayer Coating System.
Authors: Nan Xu, Yuzhou Tang, Tim Cockerill and Ardian Morina.
Abstract: Current wear monitoring methods rely mainly on indirect signals, limiting early detection capabilities at the component level. This study introduces a novel bilayer coating system for direct, real-time wear monitoring of steel components. The system integrates a diamond-like carbon (DLC) top layer for enhanced wear resistance and an optimized crystalline silicon sensing underlayer suitable for Raman spectroscopy. Although high silicon crystallinity is essential for strong Raman signals, it traditionally causes increased grain size variability and surface roughness, leading to measurement inconsistencies. To overcome these issues, deposition parameters were rigorously optimized, effectively controlling silicon grain growth. The resulting multilayer coating demonstrated reliable differentiation among wear stages (running-in, steady-state, and accelerated wear) and precise identification of coating failure. This innovative approach enables direct wear monitoring, facilitating predictive maintenance strategies, reducing lubricant usage, and enhancing energy efficiency.

Future publication plan: As this study introduces a fundamentally new technique, we will complete comprehensive experimental validation before preparing a journal submission. Our current work focuses on extending the method to capture the formation and evolution of a broader range of additive-derived tribofilms, enabling further testing and refinement of the approach. We expect to submit a full manuscript to ACS Applied Materials & Interfaces and Tribology International within the next two years.