Advanced Surface Engineering Division
Room C123 - Session SE2+TF-MoM

Surface Engineering by Deposition of Protective Coatings
Moderator: Suneel Kumar Kodambaka, Virginia Tech

10:40am **SE2+TF-MoM-8 Advanced Surface Engineering Coating Technologies for Automotive Applications***, Jianliang Lin,* Southwest Research Institute, San Antonio Texas **INVITED**

The pursuit of the automotive industry for more efficient engines to reduce fuel consumption and improve fuel economy continues. One means is to reduce the coefficient of friction (COF) of critical moving parts in engines, e.g. piston rings and camshafts using advanced surface engineering coating technologies. The presentation presents an overview of a series of efforts in the development of advanced low friction nanocomposite coatings, diamond like carbon (DLC) based coatings, and their hybrid for automotive applications. The coatings were designed and deposited using different surface engineering coating technologies, including plasma enhanced magnetron sputtering (PEMS), plasma immersion ion deposition (PIID), and high power impulse magnetron sputtering (HiPIMS). The chemistry and structure of the coatings were tailored to achieve a multi-functionality of good adhesion, low friction, low wear rate, and sufficient thickness. The coatings were iteratively optimized for its tribological performance in a series of tests including pin-on-disc test, Plint TE77 test, and block-on-ring test in engine lubricants (e.g. 10W-30) to narrow down the selection of the coatings. The nanocomposite coating showed superior performance in engine lubricants due to its unique structure and surface characteristics. Sets of piston rings were tested in a heavy-duty diesel engine to determine their wear and reliability. Finally, a full set of coated rings was tested robotically in a 4-cylinder gasoline engine on a commercial vehicle using the EPA standard method to determine the fuel economy in city driving and high way driving. This coating technology has been demonstrated to reduce COF and wear between piston rings and cylinder liners, and improve engine fuel economy. Other technical examples of tailoring the nanocomposite coating technology for improving performance of other moving parts in an IC engine (e.g., camshaft and tappets, etc) and applications in auto racing will also be presented.

11:20am **SE2+TF-MoM-10 Thin Film Materials Design & Some Thoughts on Complexity and Sustainability***, Jochen M. Schneider,* Materials Chemistry RWTH Aachen University, Germany **INVITED**

Designing the next generation of thermally stable thin films without utilizing trial and error-based methodologies requires truly predictive computational approaches. Important design criteria for protective thin film materials are, besides phase formation, mechanical behavior as well as thermal stability. Examples of predictions thereof showcasing so-called MAB phases [1], transition metal nitrides [2], and transition metal aluminum nitrides [3] which are chemically modified will be presented. Furthermore, the generation of point defects in transition metal aluminum nitrides by ion bombardment is predicted [4,5]. All aforementioned predictions are critically appraised by experimental data. Implications for future design efforts will be discussed also in the context of (chemical and structural) complexity as well as sustainability.

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