Improving the Tribological Behavior of Gears by Mechanochemical Surface Finishing

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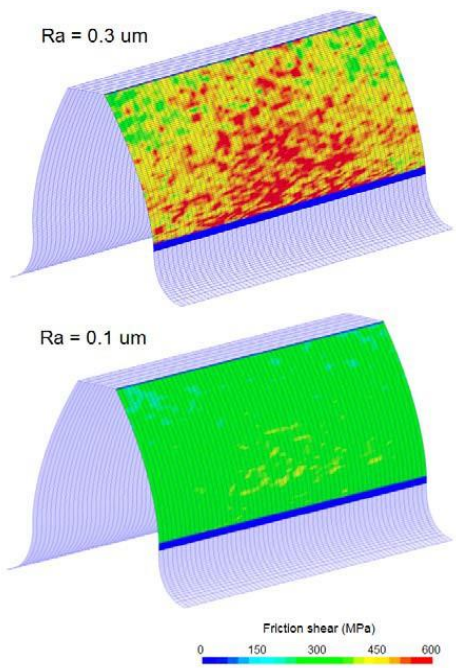
Powertrain electrification has been a growing trend in the automotive industry. While having multiple advantages over traditional powertrains, the drivetrains of hybrid (HEV) and full electric vehicles (EV) also bring up some new challenges, such as increased requirements for NVH performance in high-speed e-Drives, the need to deal with higher torques and loads while keeping an eye on the vehicle weight, and compatibility issues with some common lubricant additives.

Mechanochemical surface finishing combines elements of mechanical burnishing with a tribochemical deposition of a solid lubricant tribofim. Despite significant differences in the process flow and hardware, the treatment results in the development of a progressively plateaued roughness profile with reduced gradient roughness and increasingly negative skewness, together with the formation of a non-stoichiometric tribofilm, incorporating doping elements from the process fluid. Mechanochemically finished gears are shown to reveal improved scuffing resistance, reduced friction and wear, and less noise.
In this work we demonstrate how energy efficient lubricants and advanced surface finishing methods can help optimize the drivetrain efficiency and NHV properties. Experimental data are supported by computer simulations using an advanced thermal EHD model.



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