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Special Issue Reprint

Tribology for Lightweighting

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The Special Issue titled “Tribology for Lightweighting” defines an integrated research program linking friction, wear, and lubrication to the engineering of lighter and more efficient mobility systems. It includes studies on operational contacts and manufacturing routes for advanced high-strength steels and aluminum, together with e-mobility fluids and surface technologies, focusing on durability, surface integrity, and sustainability. The collection comprises thirteen peer-reviewed papers published between 2021 and 2026, tracing progress from polymer- and carbon-based composites to recent work on coatings and nanofluids. Exemplars include comparative assessments of diamond-like carbon versus polycrystalline diamond tool coatings for precision machining of aluminum alloys, mechanistic analyses of adhesive wear during press hardening of Al Si-coated boron steels, and formulation studies on ester-based lubricants and functional additives for electric vehicle applications. Recent contributions include studies on HVOF-sprayed cermet coatings for wear-critical powertrain components and copper-based composites evaluated under nanofluid lubrication, demonstrating translation from laboratory tribosimulators to industrial conditions. Collectively, the papers bring to the foreground quantitative performance metrics such as traction coefficient, wear rate, and tool life, providing an evidence base for adopting lightweight designs in practice.

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