

PO2025

Water Lubrication: New Prospects with Tetrahedral Amorphous Carbon (ta-C) CoatingsStefan Makowski¹, Michael Schwan¹, Frank Schaller², Volker Weihnacht¹, Andreas Leson¹¹Fraunhofer IWS, Dresden, Germany ²Technische Universität Dresden, Institute of Manufacturing Technology, Dresden, Germany

stefan.makowski@iws.fraunhofer.de

Hydrogen-free tetrahedral amorphous carbon has proven excellent low wear and low friction properties. Application of such superhard coatings as a tribological coating on tools and components has been subject of intensive research in the last years, accompanied by the industrialization of the required PVD coating technology. The role of friction and wear has been addressed in many studies motivated by the automotive industry, where additivated oils are used and complex interaction between steel surfaces, coatings, base oil and additives can occur.

In contrast, we investigated ta-C coatings in combination with simple lubricants like water and aqueous solutions of salts, acids, bases and carbohydrates in a ta-C/steel sliding contact. In general, low and stable friction coefficients of $\mu < 0.15$ were found with no wear on the coating and negligible wear on the counterpart. Aside the overall trend it could be shown that some solvents improve low friction compared to pure water, reaching friction coefficients of $\mu = 0.1$.

Opposed to that, uncoated steel/steel contacts tended to high wear and fretting with significant wear on both test specimens, impeding a stable sliding contact.

Water lubricated tribological systems based on hydrogen-free amorphous carbon coatings could unfold their high potential in chemical, maritime and food applications, where water and corrosive aqueous media are handled.

Keywords

DLC

ta-C

water lubrication

low friction

low wear