Reciprocating Sliding Wear Tests on Self-mated CVD Diamond Coatings

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Chemical vapour deposited (CVD) diamond opens the opportunity for applications in machine elements (e.g. seals, valves, bearings) and metalworking processes (e.g. wire-drawing, extrusion, deep-drawing) that require low friction and high wear resistance. Extremely high hardness and a self-lubricant effect resulting from local graphitisation of diamond in the tribocontact is determinant for this behaviour.

Previous work demonstrated that silicon nitride (Si_3N_4) based ceramics are very adequate materials to be used as substrates for CVD diamond deposition once they guarantee high adhesion levels. Si_3N_4 presents a close thermal expansion coefficient to diamond, thus reducing the thermal induced stresses at the interface, and possesses a carburizing nature enhancing diamond nucleation.

In the present work, dense Si_3N_4 samples were produced by pressureless sintering and diamond coated by microwave plasma chemical vapour deposition (MPCVD) technique. Reciprocating sliding ball-on-flat wear tests were conducted in air, at room temperature, at variable normal load, involving self-mated CVD diamond coated Si_3N_4 couples. Friction and wear results together with characterisation with several techniques (SEM, AFM, micro-Raman) lead to the comprehension of the tribological response of the system.