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Micro-scale Impact testing - a new approach to studying fatigue resistance in hard carbon coatingsArtur Kulinczak¹, Tomasz Liskiewicz², Sam McMaster², Andrew Bird¹¹Micro Materials Ltd, Wrexham, United Kingdom ²University of Leeds, Leeds, United Kingdom

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Improving the fatigue resistance of DLC coatings under highly loaded dynamic contact is an important step to increasing their performance in demanding applications. The nano-impact test is particularly effective at highlighting the limitations of thin hard carbon coatings deposited on hardened steel [1-2].

A novel micro-scale rapid impact test capability capable of producing repetitive impacts at significantly higher strain rate and energy than in the nano-impact test has been developed [3] enabling the study of coating fatigue with less sharp spherical indenters than in the nano-impact test.

This presentation describes results with the new micro-impact technique on a range of hard carbon coatings on hardened steel (multi-layered a-C, a-C:H, Si:a-C:H and WC/C). The role of mechanical properties on the fatigue resistance and the load-sensitivity of the impact failure mechanism is discussed.

[1] Nanomechanical characterization of carbon films, BD Beake and TW Liskiewicz, book chapter in Applied Nanoindentation in Advanced Materials (Wiley, Ed. Dr A Tiwari) (2017).

[2] Evaluation of the fracture resistance of DLC coatings on tool steel under dynamic loading, B.D. Beake, Surf Coat Technol 198 (2005) 90.

[3] Nano-to Micro-Impact Testing: An in-situ test for UK SEAC sector, Innovate UK Project 132369.

Keywords

impact

fatigue

DLC

micro-scale

micro-tribology