

In situ micro-mechanical testing as a basis for tool coating design

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Miniaturised mechanical property measurement is crucial for the design functional materials which are utilised at small length scales, as is the case for thin protective coatings. Through the design of a coating for tooling steel, significant advances have been made in the use of nanoindentation equipment within a scanning electron microscope, for the mechanical testing of micro-geometries. In this work, the high temperature yield strength and fracture toughness of a series of chromium-nitride based thin ceramic coatings, deposited using arc-PVD were measured using custom-built instrumentation. Properties such as the yield strength, fracture toughness and fatigue resistance of thin coatings were extracted and rationalised, including at temperatures of 500 °C [1-5], and used for the design of next-generation tool coatings. Most relevant applications of hard coatings, as for metal cutting and forging tools, often experience high temperature environments. As such, the elucidated understandings and advances allow for a sound engineering basis for designing coatings with a long service lifetime.

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