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Speaker 5

The effects of deep cryogenic treatment on a PVD - Tin coated M2 high speed steel



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ABSTRACT:

Deep cryogenic treatment (DCT) is a bulk heat treatment process that is typically applied as an extension to conventional heat treatment (i.e. quenching and tempering) applied to ferrous alloys, with numerous companies offering after-market services. DCT involves treating materials at low temperatures (-180 °C) with aim of causing microstructural and beneficial changes in their properties. In the literature, DCT has been cited to improve hardness, and wear resistance in martensitic steels. However, despite these promising results, there is limited published work on the effects of DCT on hard coated steels, such as industrial cutting tools. Much debate surrounds the topic due to lack of consistency of results encountered and limited work being presented on mechanisms responsible for changes observed. Therefore the effect of DCT have been studied on PVD-TiN coated M2 high speed steel system. A combination of mechanical techniques such as micro hardness and scratch testing have been applied to determine the mechanical changes observed. The result showed DCT can improvement composite hardness of TiN coated M2 high speed steel by 5.16%. For adhesion testing, the result suggests DCT samples had better wear resistance (3.62%) and could be attributed to the elastic modulus mismatch between the coating and substrate.



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