

Critical Review of Claims for Ultra-Hardness in Nanocomposite Coatings

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Abstract

Claims for ultra-hardness ($H \approx 100$ GPa) in nanocomposite coatings are critically examined in terms of the experimental evidence first presented in 1999 and theoretical support published over the past 10 years. It is shown that the results of experimental work cannot be validated, and that there are many unresolved issues associated with the supporting theoretical arguments. Using the methods outlined by the authors whose work is reviewed here, but with more precise application of the equations involved, and reading directly from their reported relationships between Y and H , the best estimate of the hardness for the materials under consideration appears to be of the order of ≈ 55 GPa. This estimate is validated by actual measurements on a diamond sample and super-hard coatings, and finite element computations in comparison with experimental results for ultra-hard coatings. It is shown that the conclusions of the work being reviewed do not stand up to scrutiny and that the hardness of the ultra-hard coatings are most likely over-estimated by a factor of ≈ 2 .