Ehemalige Einrichtungen

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Titel des Beitrags: Recent search for new superhard materials: Go nano!

Abstract: High elastic moduli do not guarantee high hardness because upon finite shear electronic instabilities often occur that result in transformation to softer phases. Therefore, the author concentrates on the extrinsically superhard nanostructured materials, which are the most promising. Decreasing crystallite size results in strengthening and hardening because the grain boundaries impede the plasticity (e.g., Hall–Petch strengthening in case of dislocation activity). However, this hardening is limited to a crystallite size down to 10–15 nm below which softening due to grain boundary shear dominates. This softening can be reduced by forming low energy grain boundaries or a strong interfacial layer. In such a way, much higher hardness enhancement can be achieved. The emphasis will be on the understanding of the mechanisms of the hardness enhancement. A special section deals with examples of the present industrial applications of such coatings on tools for machining in order to illustrate that these materials are already in large-scale use. In the last section, the author summarizes the open questions and limitations for the preparation of the superhard ultrahard nanocomposite coatings and possible ways on how to overcome them. VC 2013 American Vacuum Society

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