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Mechanical properties of superlattice thin films

Matthias Bartosik, Rainer Hahn, Paul H. Mayrhofer

TU Wien, Vienna, Austria

matthias.bartosik@tuwien.ac.at

Hard coatings are widely used for various applications spanning from cutting to forming tools. Multilayer coatings composed of two alternating materials with a periodicity length in the nanometer range, referred to as superlattice films, evoke much scientific interest due to their superior properties in comparison with their monolithic counterparts. For instance, exceptional high hardness values exceeding that of their single layered constituents by some hundred percent have been reported in the literature.
In this contribution, we have reactive magnetron sputtered TiN/CrN superlattice films with bilayer periods ranging from 2 to 200 nm. The influence of the film growth conditions (e.g., bias voltage) on the film structure, hardness and thermal stability were studied. By using different substrate materials within the same deposition runs allowed direct comparison of “polycrystalline” superlattice films grown on the native oxide of the Si (100) substrates and “single crystalline” superlattice films adapting their growth to the template of the underlying single crystalline MgO (100) substrates. The results were complemented by independent (transmission-) electron microscopy investigations performed for selected samples.

Keywords
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