ORB204

Coating thickness nonuniformity on cutting tools, deposited using different PVD techniques

Miha Cekada, Peter Panjan, Aljaz Drnovsek, Matej Drobnic

Jozef Stefan Institute, Ljubljana, Slovenia

miha.cekada@ijs.si

Standard industrial PVD deposition systems incorporate a substrate rotation mechanism to insure proper coating uniformity on complex-shaped substrates such as cutting tools. Though the rotation system and mounting geometry may be well optimized, the coating thickness in holes or other shaded areas will inevitably be lower. An opposite effect can happen on sharply pointing parts, which is of particular concern in processes with a high ionization rate. The term "antenna effect" is also used to describe this phenomenon. It may have a benefit to increase the thickness where the coating is most prone to wear, such as the cutting edge. On the other hand, it my cause a blundering of the cutting edge, or even increase the diameter of the tool, which can be detrimental at micrometer-sized tolerances, for instance in reamers. The effect has been well studied on simple geometries, however, the purpose of this study is to evaluate it in real industrial batches. Standard drills were put in the deposition chamber, accompanied by rods of different lengths and diameters. Both types of substrates were placed in varying geometrical environments (stand-alone or in a row) and at different heights. Two deposition systems were evaluated: cathodic arc evaporation and magnetron sputtering; in both cases standard TiAlN coating was deposited. After deposition, cross-sections were made at several positions and angles to evaluate the thickness enhancement as a function of geometry.

Keywords
arc evaporation
magnetron sputtering
antenna effect
thickness
coating