Hard coatings produced by plasma processes – technology and recent applications

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Due to economical and ecological aspects the reduction of friction and wear has a high impact on research and development of functional coatings.

A well established class of hard coatings are diamond like carbon coatings (DLC) and their metal containing derivatives Me-DLC prepared by plasma processes such as PACVD, DC magnetron sputtering and plasma activated evaporation. DLC coatings offer a high potential in realizing multifunctional properties, e.g. the combination of wear resistance and friction reduction with low adhesion, wettability, or multisensoric properties. Major application fields for DLC coatings are automotive components, mechanical engineering and tools.

The maximum hardness that can be achieved by traditional hard coatings like DLC is about 4000 HV. For higher hardness so called “superhard” coatings have to be used.

The hardest material available up to now is diamond. Polycrystalline diamond can be deposited fully automatically and highly productive on a large scale by hot filament CVD. Due to its excellent tribological, thermal and electrochemical properties CVD diamond coatings are well suited for a wide range of applications, e.g. cutting and forming tools, axial seal rings and other components with a high tribological load. Electrically conducting boron doped diamond can even be used for electrodes, e. g. for waste water treatment.

A very promising approach for new superhard materials is the development of cubic boron nitride coatings (cBN). cBN films are deposited by RF magnetron sputtering. The material offers several advantages: very high hardness, second only in hardness to diamond, high oxidation resistance and low affinity to iron - in contrast to diamond, and very high wear resistance. The mechanical-tribological characterization indicates an enormous potential of cBN coatings for tools.

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