Thin Film Technologies for Security and Defense Applications

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Thin film coatings, largely produced by vacuum deposition, fall naturally into the domain of nanotechnology1 by virtue of thickness and structure. The nano-structure of thin films is usually not the same as that of thin slices of the corresponding bulk materials and the density, porosity, crystallinity and chemical stoichiometry can be controlled by the deposition method and conditions to match particular applications.

Thin film coatings have been of enormous industrial importance for some time but recent advances in coating technologies, materials and design techniques have led to something of a revolution in real world applications. To see why this should be, it is only necessary to realise that very many of the important properties of solids depend critically on the atomic layers at the surface, e.g. roughness, hardness, friction, corrosion, colour, reflectance, electrical conductivity, thermal conductivity, bio-compatibility, haemo-compatibility, catalytic activity and wetting ability. Obviously, we can then duplicate desirable properties in a very cost effective way if we can deposit suitable thin film coatings onto the surface of bulk materials (and make them stay there).

Defense and security has driven some of the recent innovations in this field, but it is fair to say that commercial pressures and the necessity for lowering of costs and energy saving, while at the same time producing improved performance in civilian applications has also led to mutually beneficial outcomes. This has been recognised in various government 'Crossover' initiatives seeking military/commercial dual-use from research and development programs.

This talk will outline various thin film deposition techniques, materials and applications in a wide variety of sectors, including optics, mechanical engineering, energy saving and sensors, all of which have dual use in military and commerce.

References

1)F. Placido, "Thin films: A growth area for nano applications", Nano, Issue 14 (2009)