



## Seminar

Date : 02 April 2008 (Wednesday)

Time : 10:30 am -12:00 noon

Venue : EF 305, The Hong Kong Polytechnic University

### Carbon-based hard multilayer films

*Dr. A. Vyas\**

Department of Mechanical Engineering  
The Hong Kong Polytechnic University

#### Abstract

Cutting tools despite coated with hard single/multilayer coatings unfortunately offer only limited benefit in preventing such as chip/workpiece adhesion, low friction coefficient and high hardness which is one of the major problems in mechanical operating environments that greatly influences power loss and mechanical service life. The coefficient of friction values of hard coatings such as titanium nitride (TiN) and chromium nitride (CrN) are very high, typically between 0.5 and 0.9 in dry sliding, and these films also exhibit brittle mechanical behaviour which can affect their reliability. Therefore the real need for low friction to facilitate chip removal specifically in drilling, cutting and forming applications suggests research into the use of carbon-based coatings as top-coat over very hard films those being TiN, CrN.

The talk on carbon based hard multilayer encapsulates the design of carbon-based (top coat)/hard film (underlayer) combination with appropriate underlayer such as TiN, CrN to improve durability in terms of tool-life/wear and enhance the performance of coating that can result in extremely low friction coefficient and possess high hardness, high load bearing capacity and exceptionally low wear rate that aggravate's the enormous prospective of such multilayer combination for industrial applications. Such design of carbon-based film/hard film (underlayer) combination was done in a closed field unbalanced magnetron sputtering ion plating (CFUMSIP) technique. The structural, mechanical and tribological properties such as bonding status, microstructure, nano-hardness, friction coefficient, adhesion and wear resistant of these protective coatings will be presented. The accomplishment in the above research fulfills to a great extent the present need in practical applications such as drilling, cutting, milling under dry and environmentally humid conditions which certainly boost the existing modern machining technology.

---

\* Dr Vyas received his PhD in Physics from City University of Hong Kong. He then worked as a post doctoral researcher at the City University of Hong Kong and The Chinese University of Hong Kong. His current research activities are mainly focused on three major topics: (i) fabrication and characterization of advanced superhard nanocomposite materials (ii) structural, mechanical and tribological properties of thin films and multilayers (metals and nitrides), and (iii) nanoscale modeling and simulation.