Beng Kang Tay

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Â Nano-Engineered Carbon Hybrid SystemsÂ Â

Abstact:

Silicon based technology, the corner stone of todayâ€™s rapid progress and advancement have some limitations. Painful and expensive as it may, development of newer and more advanced materials is now mandatory. One of the most promising and indeed logical materials to study is CARBON, one row up the periodic table from silicon. In its form as diamond, it is the worldâ€™s hardest substance but as graphite it is soft enough to be used as pencil lead. In terms of electrical properties, diamond is a wide bang gap semiconductor while graphite and its nanostructures (such as graphene and carbon nanotubes) show outstanding transport properties. Both forms exhibit unique properties but the interesting part is the phase in between them, amorphous carbon (a-C).Â The a-C film has properties between those of diamond and graphite. Its range of properties can be tuned and modified to suit many applications by our patented Double Bend Filtered Cathodic Vacuum Arc (FCVA) technology. Besides, wide range of properties of carbon allotropes, represents a promising choice for fabrication of functional hybrid and composite materials for many different applications which is the motivation of this study.Â

In this talk the following hybrid studies will be reviewed: (i) Carbon nanomattress (CNM) consist of a-C films and the carbon nanotubes, describes a new class of fully carbon based system; (ii) Gradient amorphous carbon films (GA-C) carbon film has been obtained from a technique that employs linear increment of bias voltage applied to the substrate during film fabrication; (iii) Embedded nano-metallic-clusters in a-C matrix was studied in details using several metals including Ni, Al, Co, Ti and Fe; (iv) Metal polymer hybrid (MePH) fabricated by the combination of our patented FCVA technology and Plasma Immersion Ion Implantation technique was studied in detail.

Biography:

Professor B K Tayâ€™s research in the plasma processing of materials spans over 15 years and has resulted in over 320 publications. Prof Tayâ€™s computed h-index is 32 with SCI citations of 2850 (excluding self). Â He performed the most comprehensive investigation of the effect of ion energy on the properties of tetrahedral amorphous carbon, of which one paper has been cited >100 times since 1996. Prof Tay and co-workers successfully completed detailed studies into the science and engineering of plasma processes in filtered cathodic vacuum arc technology which overcame serious shortcomings in this technique including problems in controlling the film deposition rate and film uniformity.Â This resulted in 9 patents based on filtered cathodic vacuum arc technology. He then jointly-invented an industrial viable film deposition system where it is currently being used by storage media industries to deposit hard coatings for the production of hard disk drives. This work led him and his co-workers to win the coveted ASEAN Outstanding Engineering Award and the highly prestigious National Technology Award (Singapore) in 1997 and 2000 respectively for outstanding and pioneering R&D contributions on a new filtered cathodic vacuum arc technology. Prof Tay has also performed pioneering research in plasma ion immersion implantation and deposition which resulted in the development of novel nanostructured materials, metal nanocomposites and nanoclusters. His team won the 2007 IES (the Institution of Engineers Singapore) Prestigious Engineering Achievement Awards for their work in Nano-engineered Carbon Hybrid Systems. Professor Tay is currently the Associate Chair (Research) and the Program Director for the Nanoelectronics Materials & Devices Research Group in the School of Electrical and Electronics Engineering (EEE).