Manufacturing Science and Technology Group
Room Hall B - Session MS-TuP

Topics in Manufacturing Science and Technology Poster Session

MS-TuP-1 Formation of High Entropy Film for Cutting Tool by Magnetron Sputtering, ***Ki Buem Kim,*** Sejong University, Republic of Korea; *T Choi,* Sejong university, Korea, Republic of Korea; *H Lee,* Korea Institute of Industrial Technology, Republic of Korea; *J Lee,* Kongju National University, Republic of Korea; *Y Kim,* Sejong University, Republic of Korea; *Y Park, K Kim, S Jeong,* YG-1 Co. LTD, Republic of Korea

Hard coating application is effective way of cutting tool for hard-to-machine materials such as Inconel, Ti and composite materials focused on high-tech industries which are widely employed in aerospace, automobile and the medical device industry also Information Technology. In cutting tool for hard-to-machine materials, high hardness is one of necessary condition along with high temperature stability and wear resistance. In recent years, high-entropy alloys (HEAs) which consist of five or more principal elements having an equi-atomic percentage were reported by Yeh. The main features of novel HEAs reveal thermodynamically stable, high strength, corrosion resistance and wear resistance by four characteristic features called high entropy, sluggish diffusion, several-lattice distortion and cocktail effect. It can be possible to significantly extend the field of application such as cutting tool for difficult-to-machine materials in extreme conditions. Base on this understanding, surface coatings using HEAs more recently have been developed with considerable interest due to their useful properties such as high hardness and phase transformation stability of high temperature.

In present study, the nanocomposite coating layers with high hardness on WC substrate are investigated using high entropy alloy target made a powder metallurgy. Among the many surface coating methods, reactive magnetron sputtering is considered to be a proper process because of homogeneity of microstructure, improvement of productivity and simplicity of independent control for several critical deposition parameters. The N2 is applied to reactive gas to make nitride system with transition metals which is much harder than only alloy systems. The acceleration voltage from 100W to 300W is controlled by direct current power with various deposition times. The coating layers are systemically investigated by structural identification (XRD), evaluation of microstructure (FE-SEM, TEM) and mechanical properties (Nano-indenter).

MS-TuP-2 Plasma Diagnostics Technique using Floating Harmonic Method for Pulsed Plasma Monitoring, ***Yusin Kim,*** Samsung Electronics, Republic of Korea; *C Chung,* Hanyang University, Republic of Korea; *J Kim,* Samsung Electronics, Republic of Korea

Pulsed plasma is widely used in semiconductor manufacturing. For stable production the plasma monitoring is necessary. To measure plasma parameters such as plasma density and electron temperature in pulsed plasma, a method in high time resolution of up to 100 msec was proposed in this study. The basic principle for the measurement of the plasma parameters is to use the measured plasma current which contains fundamental current and its harmonic currents [1]. To obtain data with high time resolution, the measured currents were divided into small pieces of data in a unit time and each data were grouped and calculated. Then plasma parameters in each group were obtained. Finally, the method can measure plasma parameters in the range of msec and the measured results were compared to conventional single Langmuir probe method.

[1] M. H. Lee, S. H. Jang, and C. W. Chung, J. Appl. Phys. 101, 033305 (2007)

MS-TuP-3 Trace Level Detection of Gas Impurities Using Atmospheric Pressure Ionization Mass Spectrometry, ***Gregory Thier,*** Extrel CMS

Analysis of trace amounts of impurities in gases is crucial for applications such as Environmental Monitoring, Catalysis, Semiconductor Production, and others. Atmospheric Pressure Ionization Mass Spectrometry (APIMS) provides a technique for detecting and monitoring very low level impurities in these gases. Atmospheric pressure ionization is a chemical ionization method used in a variety of spectrometry and chromatography analyses. APIMS uses gas-phase ion-molecule collisions at atmospheric pressure for ionization and detection of trace components and impurities. Using an Extrel® VeraSpec™ Trace API Mass Spec, detection limits of less than 5 parts per trillion (ppt) have been observed. By optimizing energy of ion-molecule collisions, these low detection limits have been observed in samples with complex mixtures. This method is used for research applications of gas characterization, but has also been applied to real-time monitoring of gases.

MS-TuP-4 Novel Safe Approach to Process Gas Delivery, ***Richard Elzer,*** Entegris; *K Olander,* Retired co-founder of ATMI Corp

The history of high pressure toxic gases is riddled with safety events, actual injuries and deaths as well as near misses, some reported and many not report. In some cases, the risk profile of these gases has driven organizations to adopt low % gas mixtures that may impact process results.

Technology has been developed to store and deliver pure undiluted (neat) gases in a manner that drastically reduces the risk, with multiple technologies implemented. In one implementation, gas is stored in a gas cylinder and delivered subatmospherically.

In another implementation, gases are stored at high pressure but delivered from the gas cylinder subatmopherically. Both neat gases as well as specialty gas mixtures may be delivered from this gas package.

In a third implementation for processes requiring delivery pressures above atmospheric pressure, gases are stored at high pressure but delivered from the gas cylinder at 100psi. Again, both neat gases as well as specialty gas mixtures may be delivered from this gas package.

We will present the technologies and provide insights

improved process results

Removal of excess impurities

More deliver grams of target gas per cylinder

Insurers and Regulatory Bodies' view and preference for the safe package

Unique classifications by the US DOT

Cylinder sizes and configurations available for various applications

MS-TuP-5 Advanced Characterization to Support Development of Next Generation Phosphors, ***Vincent Smentkowski,*** *R Davis, J Murphy, A Setlur, M Butts, J Lu,* General Electric Global Research Center; *W Beers,* Current by GE

Over the past decade significant improvements have been made in phosphor technology resulting in improved brightness, color gamut, lifetime and reliability in order to meet market demands for next generation LED Lighting and display technologies. Over 20 billion $K_2SiF_6:Mn^{4+}$ containing LEDs have been sold into the display industry in less than 4 years under GE RadiantRED™ Technology.

Achieving these demands require the development of accurate, and reproducible methods to characterize and monitor the microstructure, surface, subsurface, and bulk chemistry of the phosphor powders (including dopants such as Mn^{4+}). In this poster we will highlight a sub set of the novel analytical techniques we developed with an emphasis on the analysis of dopants and their three dimensional distribution in the phosphor powders. The criticality of sample handling and preparation for accurate analysis will be addressed.

Author Index

Bold page numbers indicate presenter