Tuesday, May 12

1:30 p.m. T-7 The Morphology of Sn Thin Films on Plastic Substrates Deposited with Sputtering and Thermal Evaporation

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Sn thin films show high electrical resistance at critical thickness and typical bright metallic color. The growth mode of Sn films is island mode so that, at critical thickness, the islands of Sn do not connect with each other. This is the reason of the high electric resistance of Sn films. Therefore, the Sn thin film is a candidate for metallic coating of mobile information devices. For the deposition of Sn films, thermal evaporation and magnetron sputtering systems were used. The Sn films deposited with thermal evaporation showed the regular island size and easy control of island size with amount of Sn source. However, the films deposited with magnetron sputtering showed relatively small island size, and the island size did not control by process conditions. The small island size of Sn films deposited with sputtering affected the color of the film, which was relatively dark metallic color compared with that of the films deposited with evaporation. The adhesion of Sn films deposited with sputtering was better than that of the films deposited with evaporation.

Tuesday, May 12

1:50 p.m. T-8 Plasma-Based Deposition of Dielectric/Metal Nanocomposite Films Exhibiting Surface Plasmon Resonance Effects for the Production of Hard and Uniform Coloured Coatings

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The current state of the art for the coloured coatings is based on the interference of the light reflecting from the metal/metal oxide interface. This work addresses coloured coatings based on the surface plasmon resonance (SPRs)-induced absorption in a specific wavelength range. In this case, hybrid materials consisting of metal nanoparticles dispersed in a dielectric matrix are the subject of interest due to their functional properties for ultra thin colour filters and decorative coloured coatings. Inorganic films are particularly attractive as matrix for hard and wear-resistant coatings. Various approaches have been reported to incorporate metal nanoparticles into the host dielectric medium. The present work is concerned with the preparation of inorganic/metal nanocomposites by means of a hybrid technique, Plasma-Enhanced CVD and magnetron sputtering for the deposition of the dielectric medium and the metallic clusters, respectively. The optical properties of the nano-composite (NC) layers have been investigated by UV-VIS-NIR variable angle spectroscopic ellipsometry (VASE) and by optical transmission measurements. Rutherford backscattering/ Elastic Recoil Detection (RBS/ ERD) and InfraRed absorption spectroscopy (FTIR) were used for characterizing the film density, chemical composition and environment. AFM and TEM observation as well as the EDX analysis revealed the formation of nanoclusters.

Tuesday, May 12

2:10 p.m. T-9 New Cost-Effective Titanium Based Protective and Decorative Coatings by Ion Plating Plasma Assisted IPPA

C. Misiano, Romana Film Sottili, Rome, Italy; and P. Matarazzo and M. Pezzilli, Romana Film Sottili, Anzio, Italy

The activity aiming to replace galvanic treatments by vacuum processes is based on the effort to reduce the production costs and to set-up new decorative effects impossible to be galvanically realised because the use of dielectric materials. This work describes cost effective metal-oxide and oxide-metal-oxide decorative coatings based on the use of titanium as basic material deposited by Ion Plating Plasma Assisted from Reactive Magnetron Sputtering source. A new multilayer protective and decorative structure, based on the use of titanium and titanium oxides is also presented. The protective effect against aggressive environment is obtained by alternating layers of metal and metal-oxide mixture that exhibit good barrier properties because its microstructure. The decorative effect is obtained with a final couple of titanium and titanium dioxide or, on transparent substrates, with a titanium dioxide-titanium-titanium dioxide structure providing different colour effects on the two faces. Cost effectiveness is obtained by reducing dramatically the process requirements and duration, by simplifying the preparation and cleaning phase, reducing the pump-down time and depositing at room temperature. The treatments were realised and characterised on aluminium, stainless steel and glass substrates.

Tuesday, May 12

2:30 p.m. T-10 Broadening the Application Window of Ternary Zr Compounds by Using HIPIMS

A. Santana, Ionbond, Olten, Switzerland; A. Hieke, Ionbond Netherlands b.v., Venlo, The Netherlands; R. Fontana, Ionbond North East, Rockaway, NJ; and G.J. van der Kolk, Ionbond Netherlands b.v., Venlo, The Netherlands

ZrN and ZrCN are widely applied coatings systems, for industrial components and decorative applications. ZrON has some interesting properties linked with low surface energies. HIPIMS has been used to deposit nitrides and ternary alloys of ZrN, ZrON and ZrCN. For having a systematic comparison we deposited and characterized ZrN produced by ARC, UBM and HIPIMS technologies. The diversity found in terms of structure, mechanical properties, surface energy, corrosion resistance or simply in the colour could be still further varied by the addition of third elements such as oxygen and carbon. HIPIMS-ZrN evidenced dense structure as well as improved corrosion properties compared to other coating technologies. If on the one hand the addition of carbon in HIPIMS-Zr(C)N could allow us to obtain black colour with improved wear behaviour, the addition of oxygen to HIPIMS-ZrN was done to attempt producing combinations of antibacterial and transparent coatings. The structure of the coatings has been studied by XRD and observed by cross sectional SEM. Mechanical properties like coating hardness and elastic modulus were determined by nanoindentation techniques.

Tuesday, May 12

2:50 p.m. T-11 Decorative Coatings Obtained by Combination of PVD, Galvanic and Powder Coatings

J. Barriga, Fundación Tekniker, Eibar, Spain; C. Schrauwen, TNO Science and Industry, Eindhoven, The Netherlands; D. Gawne, London South Bank University, London, United Kingdom; C. Zubizarreta, Fundación Tekniker, Eibar, Spain; and A. Hovestad, TNO Science and Industry, Eindhoven, The Netherlands

PVD is a powerful technology for the development of decorative coatings offering interesting properties: bright metallic appearance for polymer substrates and a wide range of colors. But at the same time, this technique presents some limitations like insufficient leveling and covering of substrate defects and poor corrosion protection. The combination of the PVD processing with other coating techniques enables efficient use of the particular advantages of each coating technique. In the present work three different combinations have been investigated: 1) PVD start layer as a base for an electroplated finishing, 2) powder coating as base for decorative PVD and 3) PVD on nickel electroplated substrate. Combination of magnetron sputtering and arc evaporation was used in order to take advantages from both processes. In the first case, it has been seen that the PVD start layer replaces at least four pre-treatment steps needed for full electroplating. Even more, PVD start layer could be used to make a conductive layer on plastics that cannot be usually electroplated (like polypropylene or polyamide which have increasing interest due to economical aspects). The second combination, a first powder coating, leads to products with good surface finishing avoiding the polishing step, an improved adhesion of the PVD coating and a good corrosion protection of the substrate. The deposition of a PVD alumina layer on top of the epoxy powder coating before depositing the PVD film significantly improves adhesion, chemical and heat resistance of the coating system. Finally, it was observed that adhesion of PVD coating on electroplated nickel depends highly on the characteristics of the base coating.