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Outgassing behaviour of a polyrthylene terephthalate substrate during the reactive magnetron sputter deposition of Titanium nitride

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Magnetron sputtering is a well established and versatile physical vapor deposition process. The versatility ranges from the production of protective films to the production of functional films within electronic and optical devices. Thin metal oxide, nitride and carbide film are easily grown onto the surface of a compatible substrate by the introduction of a suitable reactive gas into the vacuum chamber. The 'Reactaflow' optical feedback system allows ceramic films with a variety of stoichoimetric composition to be grown onto a surface. The application of functional ceramic films is becoming increasingly important to plastics. High initial vacuum is known to promote adhesion prior to deposition. However it is known that most plastics outgas when subjected to vacuum. Furthermore the rate of outgassing increases when the temperature of the plastic increases due to ion bombardment. Residual gas analysis during the characterization of a UDP 450 Teer Coatings reactive magnetron sputter coater prior to another experiment revealed that polyethylene terephthalate (PET) continually outgases a considerable amount of water under plasma conditions. Water is formed as a byproduct during the polymerization of PET. The removal of water shifts the chemical equilibrium and advances the polymerization process with more production of water residual gas analysis revealed that molecular water dissociates into hydrogen and oxygen under plasma conditions. The oxygen from dissociated water was found to react along with the reactive gas nitrogen to form titanium oynitride at the surface of PET during the reactive sputtering of titanium metal. Hydrogen was removed by the vacuum system. X-ray photoelectron spectrometry revealed that the titanium oxynitride layer was in fact a phase mixture of titanium nitride, titanium oxynitride and titanium nitride. Infrared temperature measurements confirmed that outgassing increase with ion bombardment. Preheating the polyethylene terephthalate prior to deposition had no effect on outgassing behavior.

Biography

Stephen Carpenter obtained an M.Phil Eng at The University of Birmingham and his PhD at Manchester Metropolitan University UK. He now lectures material science at FURB Santa Catarina Brazil. His research interests are in the area of surface engineering and material science in general.

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Characterization of marine macro algae, *Caulerpa fastigiata* for removal of Cd^{+2}

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The removal of cadmium from aqueous solution by biosorption on a new biosorbent Caulerpa fastigiata (Macro algae) was studied as a function of initial metal ion concentration, pH, temperature, sorbent dosage and biomass particle size. The maximum biosorption was found to be 92.01% for C. fastigiata at pH 5.5 and beyond pH 5.5, Cd^{+2} ions removal rapidly declined. The data fitted with various isotherms and Freundlich model is the best with correlation co-efficient in between 0.995-0.999. Kinetic study revealed that the sorption data on Cd^{+2} with R^2 0.999 represented by pseudo second order. The thermodynamic data represents exothermic process with spontaneous nature of the process. The SEM studies showed Cd^{+2} biosorption on selective grains of both biosorbents. The FTIR spectra revealed that the functional groups –OH, COO–, –CH, C=C, C=S and –C–C– involved in the biosorption process. The XRD pattern of the biosorbent was found to be mostly amorphous in nature. C. fastigiata is a potential biosorbent for removal of Cd^{+2} ions.

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