PO1029

Process Control for TiO2 Deposition Using HiPIMS

Paul Barker[1], Glen West[1], Peter Kelly[1], James Bradley[2]

[1]Manchester Metropolitan University, Manchester, United Kingdom [2]University of Liverpool, Liverpool, United Kingdom

p.barker@mmu.ac.uk

Functional films are increasingly used in modern industry. These films must possess specific characteristics such as high optical transparency with high densities and low defect density. These characteristics are often achieved by post deposition annealing, which inherently limits the choice of substrate materials.
It would be significant to the coating industry if functional films, such as titania, TiO_2, could be readily deposited onto flexible polymeric web, rather than onto rigid glass substrates. A reduction in weight would provide many advantages for the finished products whilst roll to roll coating would lead to an increase in throughput and thus cost reductions for production. At present the post deposition annealing required to create the specific functional properties required for many applications means that polymeric web is generally an unsuitable substrate for the coatings.
HiPIMS (high power impulse magnetron sputtering) has shown potential as a possible solution to this problem. Despite the very high peak powers (up to MWs) achievable in this mode, the thermal energy flux to the substrate has been shown to be significantly reduced, compared to other magnetron sputtering processes. Furthermore, the process also produces high levels of ionisation of the target material, which offers the potential to produce high quality coatings on polymeric web without the need for post deposition annealing processing. However, to date process control of reactive HiPIMS has been problematic as conventional methods have been unsuccessful.
To address this problem, a newly introduced variant of the optical emission monitoring method, developed to work specifically with a HiPIMS plasma, has been trialled in the production of TiO_2 coatings. Stable control of the reactive HiPIMS process has been demonstrated through the production of coatings of differing oxygen content.
This paper, therefore, discusses the reactive HiPIMS deposition of TiO_2 coatings. The coatings have been characterised in terms of structure and optical properties to show the evolution of these properties through control of the oxygen content of the films.

Keywords
titania
HiPIMS
process control
functional film