Growth of Metal Oxide (Tio2/Ag) Thin Films Sputtered by Hipims Effective in Bacterial Inactivation: Plasma Chemistry and Energetic

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Abstract : High-Power Impulse Magnetron Sputtering (HIPIMS) is a technology that belongs to the field of Ionized PVD of thin films. This study shows the first complete report on ultrathin TiO2/Ag nano-particulate films sputtered by highly ionized pulsed plasma magnetron sputtering (HIPIMS) leading to fast bacterial loss of viability. The Ag and the TiO2/Ag sputtered films induced complete Escherichia coli inactivation in the dark, which was not observed in the case of TiO2. When Ag was present, the bacterial inactivation was accelerated under low intensity solar simulated light and this has implications for a potential for a practical technology. The design, preparation, testing and surface characterization of these innovative films are described in this study. The HIPIMS sputtered composite films present an appreciable savings in metals compared to films obtained by conventional sputtering methods. HIPIMS sputtering induces a strong interaction with the rugous polyester 3-D structure due to the higher fraction of the Ag-ions (M+) attained in the magnetron chamber. The immiscibility of Ag and TiO2 in the TiO2/Ag films is shown by High Angular Dark Field (HAADF) microscopy. The ionization degree of the film forming species is significantly increased and film growth is assisted by an intense ion flux. Reports have revealed the significant enhancement of the film properties as the HIPIMS technology is used. However, a decrease of the deposition rate, as compared to the conventional DC magnetron sputtering Pulsed (DCMSP) process is commonly observed during HIPIMS.

Keywords : E. coli, HIPIMS, inactivation bacterial, sputtering

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