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NANOCOMPOSITES COATINGS DEPOSITED BY GAS PHASE CONDENSATION (GPC) AND PE-CVD PROCESSES

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We present the deposition of nanocomposite coatings using a combination of gas phase condensation (GPC) and standard PECVD processes described in [1]: Metal nanoparticles (Ti, Ag, ITO) are synthesized by inert gas phase condensation (GPC) of sputtered atomic vapor, transferred into the gas flow by Gas Flow Sputtering (GFS). Low-Pressure PE-CVD allows the deposition of organic (Plasma Polymer) or inorganic dielectric matrix coatings. This experimental setup has various applications such as advanced TiO₂ photocatalytic thin films [2], conductive polymer composites for sensors [3], plasmonic coatings [4], and structured surfaces for condensation and heat transfer [5]. NPs are initially deposited randomly and homogeneously. During later stages of deposition, NPs aggregate and form a highly porous structure with low adhesion. Both pressure in the aggregation zone and discharge power strongly affect Nanoparticles Size distribution. We combined GFS and PECVD processes for the deposition of multilayer coatings with good adhesion using Isoprene (2-methyl-1,3-butadiene) or Hexamethyldisiloxane (HMDSO) as monomer precursor. We observed typical Surface Plasmon Polaritons (SPP) absorption peaks on UV/VIS spectra for multilayer coatings containing Ag nanoparticles. A redshift was observed with increasing particle size, as well as a broadening of absorption peak with increasing Ag content. When Ag content increases above the percolation threshold, the IR absorption increased, due to the formation of nanoparticle aggregates, which behave like "larger" particles. SiO₂, SiC_xO_y (precursor: HMDSO), and C_xH_z (precursor: Isoprene) have been used as dielectric matrix material. We observed the SPP peak at different wavelengths for those matrix materials. An increase in refraction index *n* results in a shift of the absorption peak toward higher wavelengths. References: [1] R. Schmittgens et al., *Plasma Process. Polym.* 6 (2009) 912. [2] M. Maicu et al., *J. Nanosci. Nanotech.* 15 (2015) pp. 6478–6486 [3] M. Wolf et al., *Procedia Chemistry* 1 (2009), pp. 879–882 [4] M. Maicu et al., *J. Vac. Sci. Technol. A* 32 (2014) p. 02B113 [5] Glöß et al., *Proc. 13th PSE*, Ed.: J. Bradley, Linköping U., 2013 pp. 64-67

Keywords

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