Plasma deposition of nanocomposite films with polymeric matrix

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In the past decades most of the attention has been paid to the nanocomposite metal/plasma polymer films. These have been studied since 70ties of the last century and have usually been prepared by simultaneous plasma polymerization and RF or later even DC sputtering of a metal target. In recent years gas aggregation cluster sources (GAS) employing a planar magnetron sputtering at high pressure (~ 100 Pa) have been used. Nanoparticles of various metals such as Ag, Cu, Al, Ti and etc. in the form of beams were produced by these sources. Ag and Al NPs were embedded into C:H plasma polymer. Cu and Ag NPs were incorporated into a-C:H(amorphous hydrogenated carbon) matrix. This material originates on RF driven DC negatively biased substrate at elevated values (usually more than -200 V). Below this value the matrix material is a hard plasma polymer (C:H). Soft plasma etching in O_2 enhanced Ag exposition and therefore short term release of Ag in antibacterial applications.

RF magnetron sputtering of Nylon 6,6 and/or PTFE targets in the GAS at pressures 40 – 100 Pa of Ar was used to prepare nanoparticles of corresponding plasma polymer. In addition, a planar magnetron with the graphite target in the GAS operated in the vapours of n-hexane or HMDSO mixed with Ar allowed to prepared C:H and $Si_xO_yC_z$ plasma polymer nanoparticles. Preparation and properties of nanocomposite and nanoparticle - nanostructured films (e.g. Ag, Ti or plasma polymer nanoparticles overcoated by plasma polymer or Ti) are described as well as GLAD (glancing angle deposition) over seed nanoparticles.

Lately, core@shell nanoparticles composed of Ag core or even Ag multicore embedded in a plasma polymer shell are presented. These are prepared in a GAS using RF or even DC magnetron sputtering in a working gas mixture Ar + HMDSO (or n-hexane). Basic physical properties of nanocomposites metal/plasma polymer films deposited from the above heterogeneous NPs are described. In conclusion further development and potential applications are discussed.

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