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NANOCOMPOSITE COATINGS WITH ENHANCED ANTIMICROBIAL AND ANTIVIRAL ACTIVITY BASED ON SILVER NANOCLUSTERS INCORPORATED INTO HARD ORGANOSILICON MATRIX PREPARED BY HIGH TARGET UTILIZATION SPUTTERING

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Silver-containing nanocomposite coatings were deposited using the High Target Utilization Sputtering technique (HiTUS) by simultaneous sputtering of Ag target and polymerization of hexamethyldisiloxane (HMDSO) vapours in the radiofrequency plasma. The presence of silver in the form of nanoclusters with dimensions below 10 nm embedded in an amorphous organosilicon plasma polymer was confirmed by X-ray diffraction and transmission electron microscopy. The silver content in the films under investigation increases with increasing the power applied to the target and decreases with increasing HMDSO monomer partial pressure. Silver is present mostly in the metallic form while the surface of Ag nanoclusters in the vicinity of the films' surface is oxidized. Addition of silver leads to a steep decrease of organosilicon polymer density, decrease of bonded carbon content, and increase of oxygen content bonded in silanol groups (SiOH). Silver incorporation intensifies the fragmentation of polymer matrix on a molecular level and changes the plasma polymerized HMDSO the same way as a transition from "soft"to "hard"plasma conditions. The nanohardness and adhesion of nanocomposite films to the sapphire substrate decrease with increase of silver content. All films under investigation demonstrate high antibacterial, antifungal, and antiviral activity which in some cases exceeds similar effects of pure metallic silver, maintaining at the same time the low level of cytotoxicity in comparison with non-immobilized free-standing silver nanoparticles.

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