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Structural And Antimicrobial Properties Of Silver Doped Hydroxyapatite Thin Films Deposited On PDMS/Si

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ABSTRACT

Due to the constant and rapid progress of modern medicine during the last years, the need for new and improved materials with application in the medical field has increased. Nowadays, one of the major problems encountered are the apparition of post operatory infections which could cause serious problems and pose a great risk to the patients. In order to avoid post operatory infections, the attention of researchers worldwide has been focused on developing novel materials which could serve as biocompatible and antimicrobial coatings, combining nanotechnology and materials science. The most investigated element known for its excellent antimicrobial properties is silver. On the basis of previous results, this study was focused on the preparation and characterization of silver doped hydroxyapatite (AgHAp) with polydimethylsiloxane (PDMS) (AgHAp-PDMS/Si) layers obtained by thermal evaporation technique. The AgHAp (x_{Ag} = 0.5) powder was deposited by thermal evaporation technique as solid layer on a silicon substrate previously coated with a PDMS layer and the AgHAp-PDMS/Si layers were characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FT-IR). The phase composition of the silver doped hydroxyapatite with PDMS (AgHAp-PDMS/Si) layers was investigated by infrared spectroscopy analyses. The antimicrobial activity of AgHAp-PDMS/Si layers was tested against *Candida albicans* strain.

EXPERIMENTAL SECTION

In order to synthesize the silver doped hydroxyapatite (Ag:HAp) precursors of calcium nitrate, ammonium hydrogen phosphate and silver nitrate were used. On the other hand, the PDMS layers have been produced in atmospheric pressure corona discharge starting from liquid precursors of vinyl terminated polydimethylsiloxane. The Ag:HAp powder was treated at a temperature of 800 degree Celsius for 6 hours and afterwards it was deposited by thermal evaporation technique as solid layer on a silicon substrate previously coated with a PDMS layer. The synthesis method was described in detail in our previous work [1]. The morphology of the obtained thin films was investigated by Scanning Electron Microscopy (SEM) using a FEI Inspect S scanning electron microscope. The top surface analysis of the samples was studied by Glow Discharge Optical Emission Spectroscopy (GDOES) using a GD Profiler 2 from Horiba/Jobin-Yvon. The IR spectra of the AgHAp-PDMS/Si thin films were acquired using a SP100 IR Perkin Elmer spectrometer (Waltham, MA, USA) equipped with a variable angle specular reflectance accessory. The measurements were carried out for an angle of reflection of 300**.** The antimicrobial activity of the obtained thin films were described elsewhere [1].

RESULTS

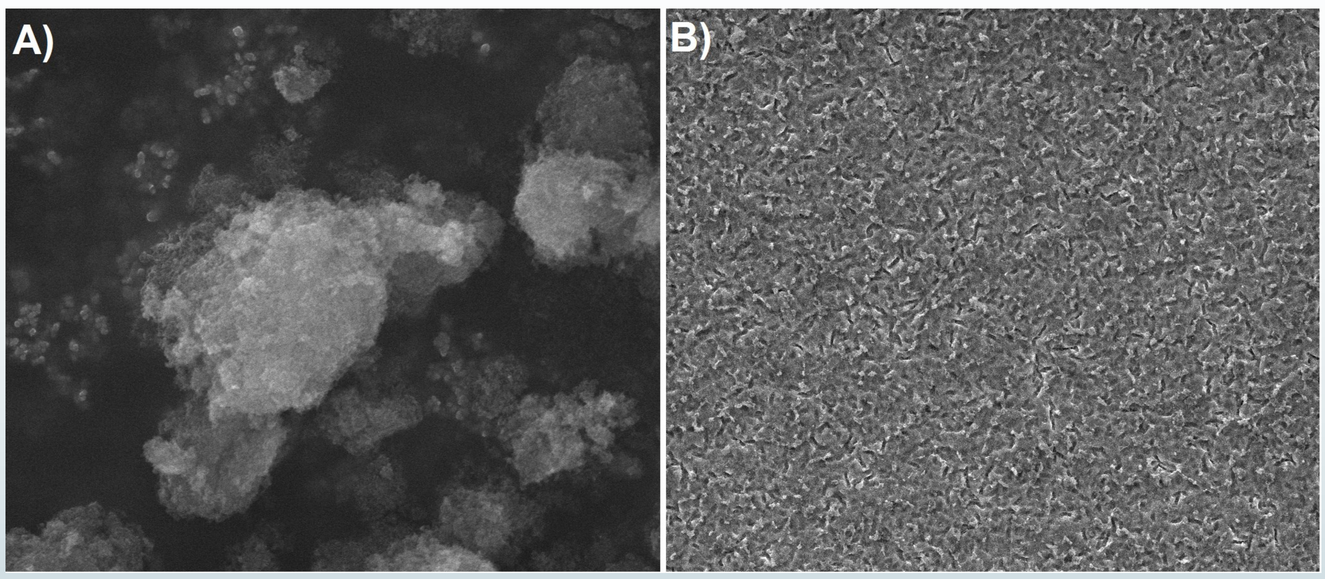

Figure 1: SEM images of AgHAp powders and AgHAp-PDMS/Si thin films.

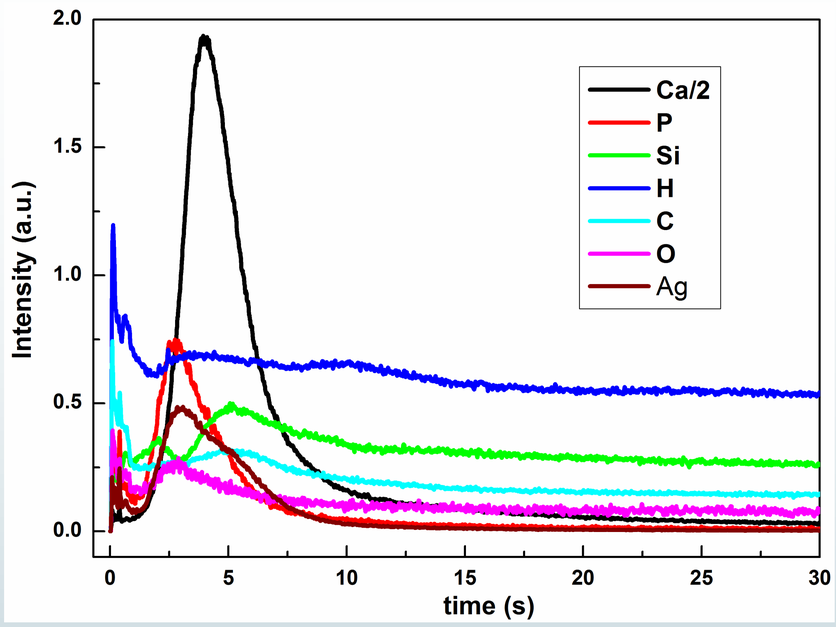

Figure 2: GDOES spectra of AgHAp-PDMS/Si [1].

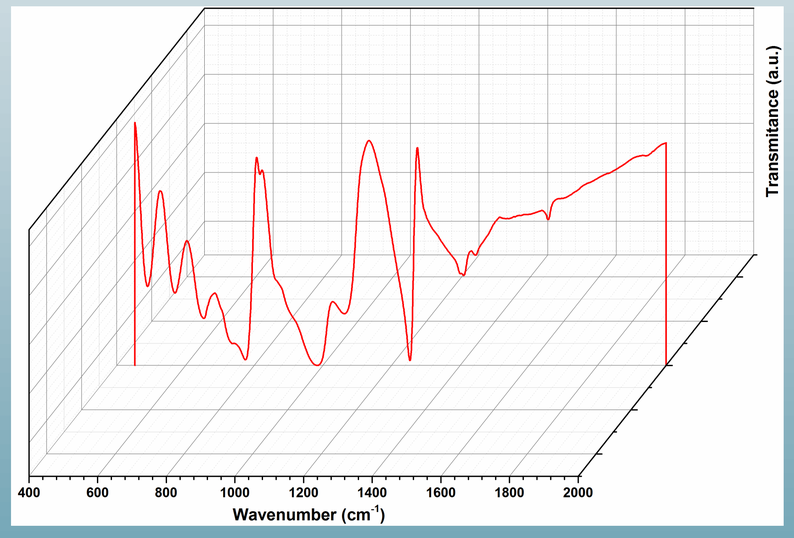

Figure 3: FTIR spectra of AgHAp-PDMS/Si thin films.

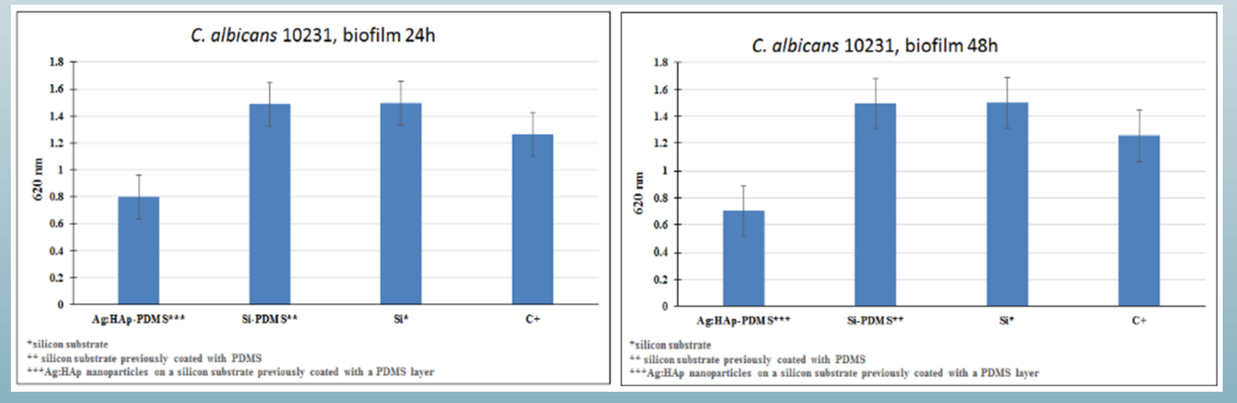

Figure 4: Fungal biofilm development on different substrates, as revealed by the density of the microbial suspension recovered from the biofilms adhered on the tested specimens [1].

CONCLUSIONS

Glow Discharge Optical Emission Spectroscopy (GDOES) was used for the evaluation of constituent elements distributed in the studied layers. In the GDOES depth profile spectrum of the AgHAp-PDMS/Si layer we marked of the surface of the polymer/substrate interface by the Si depth profile curve behavior. The results of the antimicrobial assay revealed that the microbial activity decreases significantly for the surveyed time intervals on Ag:HAp-PDMS/Si layers. The results obtained in this study showed that silver doped hydroxyapatite with PDMS (AgHAp-PDMS/Si) layers have excellent antimicrobial activity. Therefore, the deposited AgHAp-PDMS/Si layers are a good candidate for coating different surfaces with medical applications.

References: [1].C. S. Ciobanu, et al., BioMed Research International, 2015, Article ID 926513, 13 pages. [2]. A. Groza et al. Polymers 2016, 8, 131;

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