

Behavior of Printing Inks on Historical Documents Subjected to Cold RF Plasma Discharges

Authors : Dorina Rusu, Emil Ghiocel Ioanid, Marta Ursescu, Ana Maria Vlad, Mihaela Popescu

Abstract : During the last decades the cold plasma discharges made the subject of numerous studies concerning the applications in the cultural heritage field, especially concentrated on ecological and non-invasive aspect of these conservation procedures. The conservation treatment using cold plasma is based, on the one hand, on the well-known property of plasma discharges to inactivate the contaminant biological species and, on the other hand, on the surface cleaning effect. Moreover the plasma discharge produces the functionalization of the treated surface, allowing subsequent deposition of protective layers. The paper presents the behavior of printing inks on historical documents treated in cold RF plasma. Two types of printing inks were studied, namely red and black ink, used on a religious book published in 19 century. SEM-EDX analysis results in the identification of the two inks as carbon black ink (C presence in the EDX spectrum) and cinnabar based red ink (Hg and S lines in the spectrum), result confirmed by XRF analysis. The experiments have been performed on paper samples written with laboratory- made inks, of similar composition with the inks identified on historical documents. The samples were subjected to RF plasma discharge, operating in nitrogen gaseous medium, at 1.2 MHz frequency and low-pressure (0.5 mbar), performed in a self-designed equipment for the application of conservation treatments on naturally aged paper supports. The impact of plasma discharge on the inks has been evaluated by SEM, XRD and color analysis. The color analysis revealed a slight discoloration of cinnabar ink on the historical document. SEM and XRD analyses have been carried out in an attempt to elucidate the process responsible for color modification.

Keywords : RF plasma, printing inks, historical documents, surface cleaning effect

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020