DEPOSITION OF HMDSO BY AN AEROSOL-ASSISTED MICRO PLASMA DEVICE

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1. Introduction

Organic and inorganic compounds have been used as precursors to generate chemical reactions using atmospheric discharge plasma devices for deposition of nanomaterials [1]. The liquid precursor is atomized and injected in aerosol form into the discharge. The plasma device is usually an arrangement of parallel or coaxial plates and the discharge evolves in the gap in form of randomly distributed filamentary discharges. One alternative method was investigated using micro-plasmas successfully used to deposit polymeric films.

2. Experiment

The micro plasma is produced between a brass disk with an orifice that can be connected to the ground and a coaxial needle with outer diameter 0.70 mm connected to the high voltage source. An equally coaxial borosilicate capillary is used as dielectric between these electrodes to generate plasma. Figure 1 shows a schematic view of the device. The compound either atomized or in vapour form that is produced respectively by burbling or evaporation is dragged off by the gas to the needle to generate plasma. The main tube has two sections diameters: 2 mm at the entrance of the gas and 1 mm at opposite side. Each section an aperture connects the gas line to the compound vessel. The input voltage and output current were monitored and measured by an oscilloscope Tektronix TDS2024C.

3. Results and discussions

The deposition of HMDSO was performed on glass substrate using argon at 1.0 L/min flow rate and a peak-peak voltage up to 4.5 kV at 37 kHz frequency. Monomer solution was kept at room temperature of 23 °C. The glass substrate was placed at 4 mm from the end of the capillary. A typical absorbance curve of the film obtained by FTIR (Fig.2) shows the presence of $Si(CH_3)_3$ at 840 cm^{-1} region, SiOSi at 1042 cm^{-1}, $Si(CH_3)_x$ at 1258 cm^{-1} and CH_x at 3000 cm^{-1}. Qualitative measurements on the adhesion of the films indicated strong dependence of this parameter with the concentration of the monomer in the discharge.

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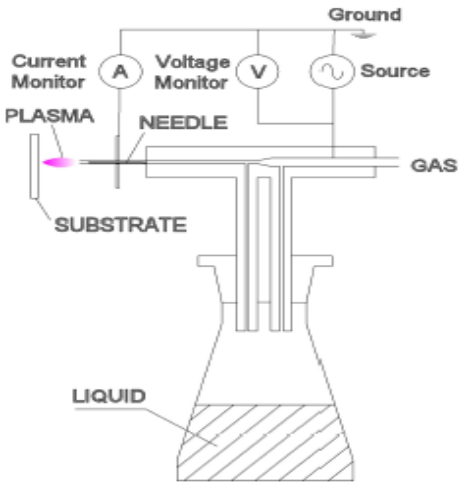

Fig.1 – *Schematic view of aerosol-assisted micro-plasma device.*

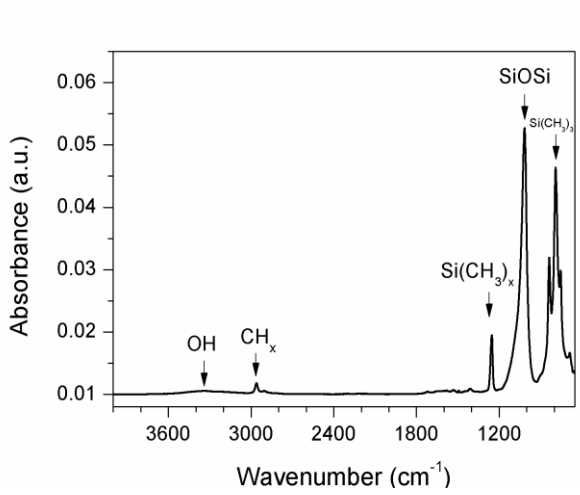

Fig.2 – *FTIR of an HMDSO coating deposited on glass substrate.*

References

[1] Fanelli, F., Lovascio, S., Fracassi, F., *Ar/HMDSO/O_2 Fed Atmospheric Pressure DBDs: Thin Film Deposition and GC-MS Investigation of By-Products,* Plasma Processes and Polymers, v. 7, no. 7, pp. 535-543, 2010.