CHARACTERISTICS OF AN AEROSOL-ASSISTED MICRO PLASMA DEVICE

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1. Introduction

The atmospheric discharge plasmas using precursors have been used for deposition of nanomaterials using organic and inorganic compounds [1]. The liquid precursor is atomized and injected in aerosol form into the discharge. The plasma device is usually an arrangement of parallel 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. The characteristics of the device using this method are shown in the present work.

2. Experiment

The high voltage to generate the plasma is applied between the needle and a coaxial brass disk. An equally coaxial borosilicate capillary is used as dielectric between these electrodes. A schematic view of the device is shown in figure 1. A tube with two sections connects the needle to the gas system. The diameters of sections are 2 mm diameter at the entrance of the gas and 1 mm at the end with the needle. In each section an aperture connects the gas line to the compound vessel. By burbling or evaporation of the compound the element is dragged to the needle to generate the plasma. The mass of water, alcohol, acetone and HDMS dragged by the flow of compressed air and/or argon was measured performing periodic measurement of the mass in the vessel.

3. Results and discussions

Figure 2 shown a typical mass of HMDS(O) dragged in the device operating with argon at 0.3 L/min flow rate. The loss by evaporation at 23^{O}C in the vessel is shown as reference by curve (d). In partial dragging mode leaving only one of secondary tubes opened are curves (b) and (c). The mass removed from the vessel rises slightly. The difference between the curves is due to the larger diameter of the capillary in (b). The curve (a) shows the operation in normal mode. The dragging of mass occurs at rate 0.043 g/min in this case. This behavior was also observed for other compounds and gas in main tube showing a reliable operation for aerosol assisted plasma processing.

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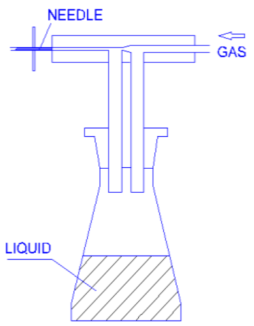

Fig.1 – Schematic view of aerosol-assisted micro-plasma device.

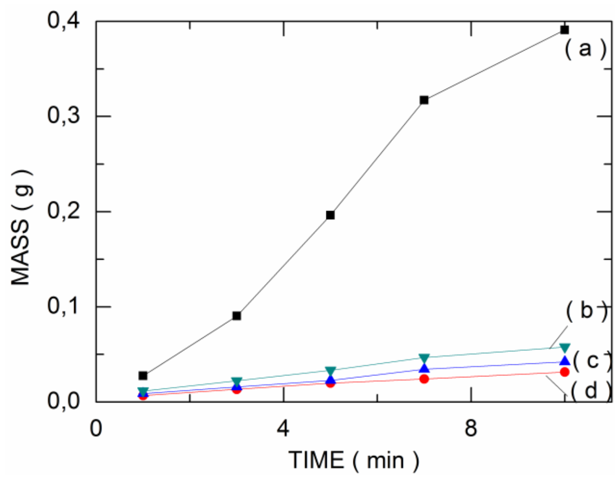

Fig.2 – Variation of HMDS(O) mass by different conditions of the tubes: a)both opened, b)right opened, c)left opened, d)evaporation.

References

[1] Fanelli, F., Fracassi, F., *Aerosol-Assisted Atmospheric Pressure Cold Plasma Deposition of Organic-Inorganic Nanocomposite Costings*, Plasma Chem. Plasma Process, v. 34:473, 2014. Doi:10.1007/s11090-013-9518-9

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