PLATHINIUM
PLASMA THIN FILM INTERNATIONAL UNION MEETING
13-17 September 2021
WWW.PLATHINIUM.COM
VIRTUAL MEETING

#PLATH00088

NANO / Nanomaterials and nanostructured thin films

Charge gas and discharge parameters influence on kinetic and nucleation in RF Ar/C_2H_2 plasmas

G. Tetard[1], A. Michau[1], S. Prasanna[1], J. Mougenot[1], P. Brault[2], K. Hassouni[1]
[1] *LSPM, Villetaneuse (FR)*
[2] *GREMI, Orléans (FR)*

Abstract content

Low pressure Ar/C2H2 CCRF plasma with a showerhead electrode inlet gas configuration has been studied with a 1D fluid model. This model coupled a 13.56MHz RF discharge module and a long time scale module for describing chemistry and molecular growth kinetics. The flow influence on the discharge equilibrium and the surface processes is analyzed. Such plasmas are characterized by a strong coupling between electron-impact and argon metastable quenching on acetylene. This leads to the formation of hydrocarbon ions and radicals by ionization and dissociation reactions which result in molecular growth through neutral and ionic routes. A study over the discharge and the feed gas parameters has been performed in order to understand their impact on the plasma dynamic, the different nucleation routes and the surface deposition. Figure 1 shows the effects of the flowrate on the electron density, ne, and temperature, Te, for a 96:4 Ar:C2H2 discharge at 10 Pa. At high flowrate, the discharge is dominated by C2H2+ as the acetylene is easier to ionize. One can see that the decrease of the flowrate leads to a smaller electron density and an Ar+ dominated plasma due to a higher depletion of C2H2. The composition of the gas also affects the plasma and the chemistry. The influence of the percentage of acetylene in the feed gas on the kinetics of neutral and negative nucleation and of surface deposition on the electrode is presented in figure 2 for a flowrate of 18.6 sccm and a pressure of 10 Pa. This work also underlined the key-role of Argon metastable in the kinetics of carbon materials (films or dusts) production in non-equilibrium discharges.

Thanks/Acknowledgement

This work was partly supported by the French National Research Agency (ANR) through the MONA project (ANR-18-CE30-0016)

References

I Stefanovic et al 2017 Plasma Sources Sci. Technol. 26 065014

ne and Te in a 4:96 Ar:C2H2 10 Pa RF plasma