PRODUCTION OF NEGATIVE IONS ON HOPG SAMPLE IN H2 BASED PLASMAS

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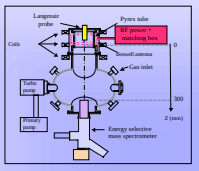
"PHISIS" and his diagnostics



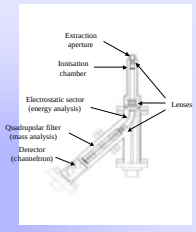


Fig. 3 : Sketch of the mass spectrometer with resolved energy (Hiden EQP 300)

Fig.1 : photo and sketch of our helicon

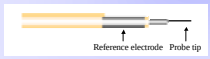


Fig.2 : sketch of the Langmuir probe tip (Scientific Systems)

Langmuir probe (Fig.2) gives (V_p, V_f , T_e, n_e, n_i) whether mass spectrometer (Fig.3) performs a local analysis of neutral species and ions with moreover an energy resolution

Sample and Negative ion detection

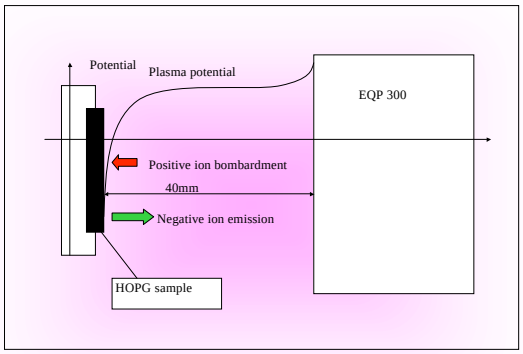
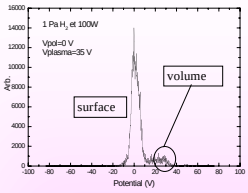
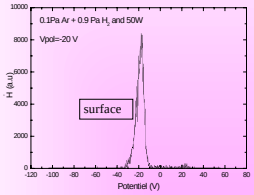


Figure 4 : negative ion collection by our spectrometer

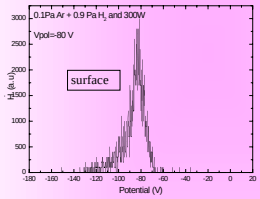
Exemple of IEDF for negative H- ions



IEDF which shows contribution of negative ion in volume which means close to plasma potential and another peak at the sample potential.



By increasing energy of incoming ions, we clearly measure an increase of the surface peak while the volume contribution remain the same.



Surface peak decrease for energy higher than 60 eV (here 105 eV for positive incoming ions) , and we could see a high energy contribution which is du to a double capture process.

Figure 5 : H- IEDF for different sample biased potentials(0V, -20V, -80V) and identical hydrogen plasma

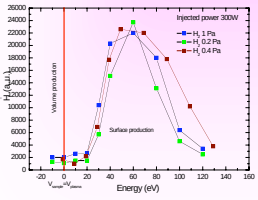


Figure 6 : H- surface peaks for incoming ion energy in hydrogen plasma

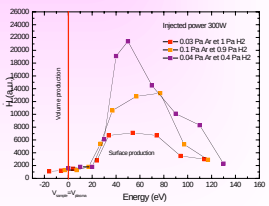


Figure 7 : H- surface peaks for incoming ion energy in mixture Argon hydrogen plasma

Highest Chemical reaction rates

$$H + H \xrightarrow{Surf} H_2^*$$

$$H_2^* + e^- \rightarrow H^-$$

volume production

$$H^+ \xrightarrow{Surf} H^-$$

DOUBLE CAPTURE

$$H_2^+ \xrightarrow{Surf} H^- + H$$

$$H_3^+ \xrightarrow{Surf} H^- + 2H$$

$$ArH^+ \xrightarrow{Surf} Ar + H^- ?$$

We present reaction rates for two process, on in volume which use excited hydrogen in order to produce in volume negative ions. Also we list some reactions on surface which take into account two electrons capture. We do not focus on hydrogen adsorption but it really plays a role by means of coverage rate.

CONCLUSION

The aim of this study was to improved negative ion production source, understand dust chemistry and also sheath stability.

We clearly show behavior of negative ion versus energy of the incoming ions and versus time. These result are still analyzed in order to make a small model which take into account the covering rate of hydrogen, atomic hydrogen, incoming positive ions (H+,H2+,H3+) and (Ar+,ArH+).

We show at first glance that the effect of argon does not have a huge influence an surface reactivity. The main effect of additional argon is to increase ion density by reducing ion-ion recombination.

A clear difference is seen on process by one electron and process by two.

By comparing volume and surface negative ion production, we show that surface is more efficient.

More investigations will be done to understand what happens on the HOPG surface when energy is higher than 70 eV, the question is still open.

A clear difference is seen on process by one electron and process by two.