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C12A7 エレクトライドの仕事関数ならびに負イオン生成挙動
H^- production and the work function behavior of C12A7 electride in low temperature plasmas

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C12A7 electride is considered as one of the possible plasma electrode materials of Cs-free negative hydrogen isotope ($H^-/D^-/T^-$) ion sources. We have been carried out the work function measurements [1], H^-/D^- ion spectra measurements from a C12A7 surface facing to a low-density hydrogen plasma [2], and extraction of negative ions from a small aperture of a C12A7 plasma electrode [3,4], and favorable results were reported.

Recently, C12A7 electride material is studied with regard to the work function behavior in a hydrogen and deuterium plasma environment on the laboratory experiment device ACCesS [5, 6]. The material has proven to be resilient to hydrogen and deuterium plasma exposure at ion source relevant conditions. After initial conditioning of the surface by thermal annealing and plasma exposure, short plasma pulses lead to a work function to ~3.2 eV, and the application of a positive bias potential further lowers the work function to slightly below 3 eV. In contrast, the application of a negative bias potential leads to an increase of the work function and a strong decrease of the photoelectric yield of the surface [7].

Similar behavior on change of the work function by the plasma bombardment at a positive bias was observed from a C12A7 electride target on a device, *PIIM*, and *PYS* (photoelectron yield spectroscopy) in Aix- Marseille University [8, 9]. The lowest value of the work function observed was ~2.5 eV after annealing up to higher temperature. This value was confirmed by UPS measurement with the similar conditioning procedure.

H^-/D^- spectra from a C12A7 electride target immersed in a hydrogen plasma were measured simultaneously at *PIIM*. Fig. 1 shows Negative Ion (H-/D-) counts measured with EQP 300, vs. work function measured by *PYS*. Peak counts are mostly contributed by desorption by scattering.
The target was biased negatively at 60V, and the surface was bombarded by positive ions, mainly H_3^+. The dependence on the work function is weak, and the negative ion yield by D_3^+ ion bombardment is lower than by H_3^+. The peak counts from C12A7 are one order higher compared with those from a clean molybdenum (shown by 2 solid lines).

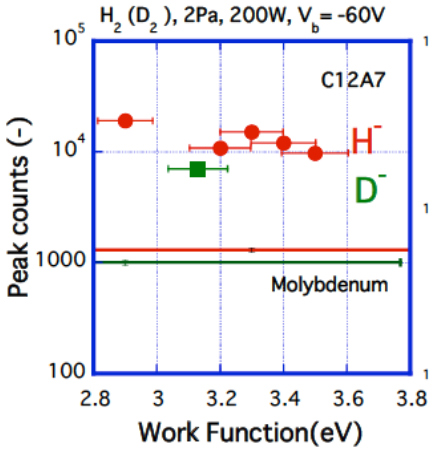

Fig. 1 H^- yield dependence on work function

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