Studies of Atomic Tin Release from LiSn and Sn CPS Samples in TJ-II.

F L Tabarés*, E. Oyarzabal, D. Tafalla, M.A Ochando, F Medina, K. J. McCarthy, A. Baciero, B. López-Miranda, I. Pastor and the TJ-II Team

1National Fusion Laboratory, CIEMAT, Av Complutense 40, Madrid 28040, Spain.

*Email: tabares@ciemat.es

Abstract.
A full campaign of comparative Li/LiSn/Sn testing has been initiated in TJ-II plasmas [1,2]. Solid and liquid samples of the three candidates, in a Capillary Porous System (CPS) arrangement, have been exposed to the edge plasma and the associated perturbation of the core plasma has been recorded. The surface temperature of the liquid metal/CPS samples (a tungsten mesh impregnated with Sn, SnLi or Li) has been measured during plasma pulses with ms resolution by pyrometry and radial profiles of Li, Li+, Sn (at 452.4nm) and Hα were recorded together with the electron edge parameters. A simple 1D model was applied to the data, allowing for the evaluation of the kinetic energy (E_k) of ejected atomic species while their residence time at the edge was determined by monitoring the ratio of first ion/neutral emission light intensities. A clear evolution of E_k with sample temperature was deduced for Li atoms, this being associated to the different relative contributions of sputtered/evaporated atoms. The recorded Li+/Li ratios were analysed through a simple model accounting for several mechanisms for the dispersal of the injected impurity from the injection location, allowing for an evaluation of the minimum residence time of Li ions at the plasma periphery.

SnI emission into the plasma has also been recorded with radial and toroidal resolution. Both, pure Sn and LiSn LMs in a CPS support were used for that purpose. The spatial resolution of the detector system was improved by factor of two with respect to previous experiments [3]. In addition, a single Langmuir probe was located at the tip of the LM sample. The deduced mean free paths for the ejected Sn atoms under sputtering conditions (low T) imply unrealistic high energies if the bibliographic data for the ionization rate constant of Sn are assumed. For the LiSn case, Li as well as Sn emissions were simultaneously detected and analysed. Plasmas under cut-off (collapsing) conditions were also investigated in order to check for the sensitivity of the recorder line intensities and ionization rates to the edge electron temperature.

In this paper, a full account of the results obtained and their implications for the use of LM/CPS concepts in a future Fusion Reactor and devoted transport models are addressed.

