

High Resolution EUV Spectroscopy on FTU with Tin Liquid Limiter

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FTU is an all-metal limiter machine characterized by an extremely low level of impurities of any kind, therefore it is particularly well suited for investigating the performances of liquid metal limiters under high thermal loads (up to 18 MW/m²). During recent experimental campaigns the plasma behaviour has been studied with a Tin Liquid Limiter (TLL), while previous tests were carried out with a Lithium Liquid Limiter [1]. In the last campaign, a 2m grazing incidence *Schwob-Fraenkel* XUV spectrometer [2], observing the plasma emission in the range from 20 to 340 Å, was installed on FTU. Experimental data of Tin spectra from high temperature plasmas are scanty; for this reason, our first goal was the identification of the main spectral lines, to support further studies of the possible influence of Tin in the plasma core, and to complement previous observation regarding vaporization and plasma contamination.

The high spectral resolution of the Schwob instrument when equipped with a 600 g/mm or 1200 g/mm grating allowed the identification of spectral lines of Sn ionization stages up to SnXXIV. The tin lines have been isolated against the metal-dominated background spectrum typical of FTU plasmas in a limited range of plasma parameters ($B_T=5.3$ T, $I_p=0.5/0.7$ MA, $T_e \leq 1.5$ keV, $n_e \leq 10^{20}$ m⁻³). The vertical position of the TLL was varied on a shot by shot basis in a range of 4 cm up to the last closed magnetic surface.

The unresolved transition array at about 135 Å [3] that was recorded previously with a survey, low resolution SPRED instrument, has now been resolved. The combination of these observations with those of other instruments in the visible spectral range have led to estimated values of Sn relative concentration of the order of 5×10^{-4} in the plasma core [1].

[1] G. Mazzitelli, et al., "Comparison between Liquid Lithium and Liquid Tin Limiters in FTU", EPS 2017.

[2] J.L.Schwob et al., *Rev. Sci. Instrum.* **58** (1981)1601.

[3] G. Apruzzese, et al, "First Spectroscopic Results with Tin Limiter on FTU Plasma", ISLA 2017.