

# Ionization competition effects on K-shell emission spectra of mixture plasmas

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Heating thin foils with a high-power laser at intensities of  $10^{17}$ - $10^{19}$  W/cm<sup>2</sup> produces high-temperature, high-density plasma to investigate X-ray opacities and equations of state [1]. The mechanisms governing the propagation of the laser-accelerated electrons and their energy deposition into dense materials have been extensively investigated over the past years, mainly in the framework of the Fast Ignition approach to Inertial Confinement Fusion (ICF) [2]. Our campaigns at the PICO2000 laser facility provided measurements of the accessible temperature range in buried samples within a thin foil: detailed Al and Ti K-shell spectra interpretations lead to a  $\sim 1$ keV temperature at almost solid density. In addition, time-resolved spectra were consistent with such a temperature, which is the key parameter to match the emission temporal profile. Complex atomic physics were required to reproduce the experimental data (accurate impact broadening, detailed atomic states subject to external ionic distribution of microscopic electric fields, accurate plasma screening and ionization potential depression). We also investigate mixed samples with high- and low-Z atoms, in our case Al/Ti mixtures, where the high-Z atoms dominate the radiative properties and strongly impacts the emission from the low-Z atoms. These studies are of particular interest for ICF research corresponding to hot-spot conditions and doped ablator mixing in the D-T fuel.

[1] K. Eidmann et al., JQRST 81, 133–146 (2003)

[2] M. Tabak et al., Phys. of Plasmas 1, 1626 (1994).

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