Spectroscopy of injected impurities: fundamental atomic data and collisional-radiative modeling

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Since the First Research Coordination Meeting of the CRP, a number of new and/or updated atomic parameters related to injected impurities were added to the NIST Atomic Spectra Database (ASD) [1]. ASD has been extensively updated twice (December 2023 and November 2024) bringing the total number of spectral lines to almost 301,000 transition probabilities to 129,000 and energy levels to more than 120,000. We will summarize the new additions for the first-row and noble gas atoms and ions and describe other improvements and novel features in ASD.

Also, collisional-radiative (CR) modeling for several of injected impurities will be reported with regard to spectra simulations in a typical plasma of an electron beam ion trap (EBIT). In EBITs, various gases such as nitrogen, neon and xenon are often used for spectroscopic calibration and a proper identification of their spectral lines becomes imperative. While quasi-monoenergetic electron energy distribution function in an EBIT is different from a Maxwellian distribution in tokamaks and stellarators, nonetheless, detailed spectral modeling for EBIT plasmas can reliably benchmark CR codes of a more general nature. Examples of such modeling for injected impurity gases in the NIST EBIT will be presented and discussed.

[1] URL https://www.nist.gov/pml/atomic-spectra-database