Cross sections for electron scattering from atomic tin

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The relativistic convergent close-coupling (RCCC) [1] method was applied to calculate a comprehensive set of collision cross sections for electron scattering from atomic tin. Such collision data-sets are of interest to the plasma physics community due to their applications for modelling fusion plasma involving tin. The wall tiles of tokamak fusion reactors such as ITER erode over time due to bombardment by the fusion plasma. A proposed method to monitor this erosion is to embed a marker such as tin into the wall tiles which will enter the fusion plasma after some level of erosion and produce a spectral signature [2]. The nano-lithography industry will also benefit from such scattering data, particularity with respect to the production of extreme ultraviolet (EUV) light which is generated using a plasma of tin ions [3], the modelling of which will benefit from a comprehensive set of collision data.

We calculated cross sections for electron scattering from neutral tin in the ground and first few excited states. This included integrated and momentum transfer cross sections for elastic scattering and integrated and differential cross sections for excitations to the $5p^2$, $5p6s$, $5p5d$ and $5p6p$ manifolds. Total ionisation cross sections were obtained which included the contributions of direct ionisation out of the valence $5p$ and closed $5s$ shells and also indirect contributions due to excitation auto-ionisation. All cross sections calculated for the ground $^3P_0$ state of atomic tin are illustrated in figure 1. For total ionisation cross sections we find good agreement with experiment and other theories whilst for excitation cross sections the agreement is mixed.

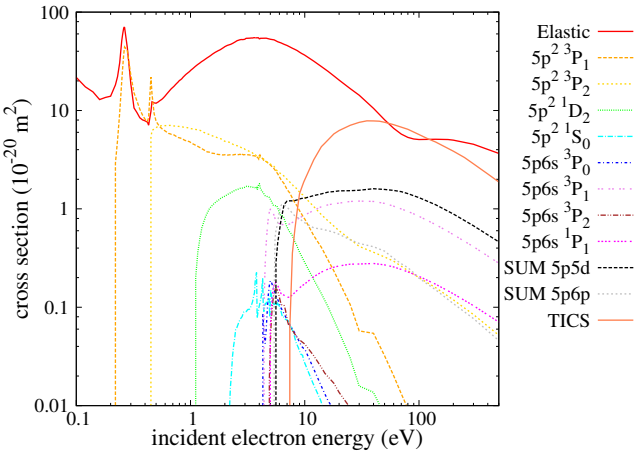

Figure 1: *Set of cross sections calculated for electron scattering on the $^3P_0$ ground state of neutral tin.*

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[2] A. Foster, G. Counsell, G. Summers, Journal of Nuclear Materials: J NUCL MATTER, **363**, 152 (2007)

[3] G. O'Sullivan, B. Li, R. D'Arcy, P. Dunne, P. Hayden, D. Kilbane, T. McCormack, H. Ohashi, F. O'Reilly, P. Sheridan, E. Sokell, C. Suzuki, T. Higashiguchi, Journal of Physics B: Atomic, Molecular and Optical Physics, **48**, 144025 (2015)