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Atomic data of low-charged Sn ions for lithography applications[1]

JAMES COLGAN, D. P. KILCREASE, J. ABDALLAH, M. E. SHERRILL, C. J. FONTES, P. HAKEL, Los Alamos National Laboratory — Sn is one of the most promising materials that has been investigated to date in the quest to make intense radiation sources for EUV lithography. Sn plasma readily produces an intense, narrow, emission band around 13.5 nm, a feature that has long been studied in efforts to exploit this useful property. The efforts to predict the properties of Sn that produce these intense emission features are complicated by the complex atomic structure of the Sn ions in question. We have begun investigations into the opacity of Sn at low temperatures. We have explored the accuracy of some approximations used in opacity models for Sn. The use of intermediate-coupling, as compared to full configuration-interaction (CI), is not adequate to obtain accurate line positions of the important bound-bound transitions in Sn. One requires full CI to properly describe the strong mixing between the various n=4 sub-shells that give rise to the Δn=0 transitions that dominate the opacity spectrum at low temperatures. Calculations that include full CI for large numbers of configurations quickly become computationally prohibitive, so we have explored hybrid calculations, in which full CI is retained only for the most important transitions [1]. [1] J. Colgan et al, HEDP **23**, 133 (2017).

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