Recently, we have reported on the investigation of electron production mechanisms in H-like and He-like [1, 2] boron ions in collisions with \( \text{H}_2 \) gas targets. The projectile electron spectra were found to result predominantly from the Auger decay of doubly or triply excited [3] states produced by direct capture or resonant elastic/inelastic scattering of quasi-free target electrons off the ions. Here, we follow-up these investigations with a report on electron production in 4-8 MeV collisions of Li-like \( B^{2+}(1s^22s) \) with \( \text{H}_2 \) targets.

The high resolution spectra for all the boron charge states were recorded at zero-degrees with respect to the ion beam with a mean instrumental energy resolution of 0.2% and an absolute experimental uncertainty in the Auger line energy (projectile rest frame) of 0.6–1.1 eV. The three electron spectra for \( B^{2+} \) collisions with \( \text{H}_2 \) are shown in Fig. 1. The Be-like \( 1s2s2p^23^1D \) lines are known to be produced by resonant elastic scattering off the \( B^{2+} \) ion of the quasi-free \( \text{H}_2 \) electrons. These lines go through a maximum at the ion collision energy of 3.8 MeV. The Li-like \((1s2s)2p^22^3P_−\) and \(1s2p^22^3D \) lines are produced by direct excitation. The energies of higher-lying KLn lines \((c_1−c_{10})\) have been compared to Hartree-Fock calculations using the Cowan code. Our analysis shows most of these lines can be assigned to Li-like \( 1s2nl'' \) states with \( n = 3 − 4 \) Auger decaying to the \( B^{3+}(1s^2) \) ground state. The proposed intermediate states, the Auger electron energies resulting from their decay to the ground state, and the most probable production mechanisms are discussed.

References


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