Electron and Positron Induced Scattering from Propene

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Propene has received lot of interest recently due to its presence in the edge plasma region of high temperature plasma apparatus. It is one of that hydrocarbons produced in fusion plasmas as a by-product of plasma irradiation at the diverter regions and to some extent, at the tokamak walls following repeated sputtering of the graphite walls [1]. The electron collisions with molecules relevant to plasmas have received much attention over the years for various plasma modelling applications. However, positron collisions with such molecules are relatively new. With opposite charge and similar mass as that of an electron, positron collision with molecules are of interest to plasma due to their annihilation with electrons to form neutral plasmas having dynamical symmetry between the charged species. Recent years have seen huge interest in laboratory experiments on electron-positron plasmas such as PAX and APEX [2]. Hence, the study of positron impact cross section for molecules as above is pertinent to plasma modelling. Moreover, propene is also an important astrophysical molecule present in the lower atmosphere of Saturn's moon Titan [3]. The Curiosity Rover has discovered some traces of propene on the surface of Mars [4] as well. Since these astrophysical bodies are prone to cosmic rays producing enough of electron/positron, the study of the collision dynamics of this molecule will be of great help to the modelling community.

A comparative study of electron and positron scattering on any target gives a better understanding of the scattering mechanism for that system. Moreover, for positron collisions the low energy resonance structures such as shape or feshbach-type are absent, contrary to what observed for electron scattering. The total cross section curve for positron scattering follows a smooth trajectory than that of electron scattering. Hence, for positron scattering calculations the spherical complex optical potential (SCOP) [5] formalism is employed for the calculation in the energy range from positronium formation threshold to 5000 eV. However, for low energy electron scattering, we have used R-matrix (via QUANTEMOL-N [6]) and SCOP method intermediate energy range. The present work presents electron and positron scattering cross sections such as total, elastic, momentum transfer and direct ionization cross sections. Comparisons are made for both projectiles with the data available from literature.

References

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