

Positron Scattering Cross Sections For Plasma Relevant Hydrocarbons

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Positrons are easily obtainable form of antimatter in the laboratory. Recent progress in the development of trapping methods and storing positrons now permits the accumulation of a sufficient number of low-temperature positrons to form plasma [1]. Positrons are of interest to plasma physics because they annihilate electrons and because of having the same mass and opposite charge, positrons and electrons can be combined to form neutral plasmas with a dynamical symmetry between the charged species. Recent years have seen a huge interest in laboratory experiments on electron-positron plasmas such as PAX/APEX experiment. Contrary to the intuition, under good vacuum conditions the lifetime of such plasma is not primarily limited by annihilation of particles with their anti-particles. It could live for few minutes or even hours [2].

Analyzing these aspects of positrons in plasma, it is highly probable that positron scattering studies of plasma relevant molecules has numerous applications. Cross section data for collision processes involving positron impact of hydrocarbons (C_2H_6 , C_2H_4 , C_2H_2 , C_3H_8 and C_3H_6) are necessary for understanding and modelling diverter plasmas, where such molecules are produced through proton-induced chemical sputtering of graphite tiles used for the first walls of present-day and future tokamak fusion devices. Moreover, the cross section data are also needed to elucidate the mechanisms of astrophysical phenomena [3] and to control plasma processing employed in industry [4].

A modified version of spherical complex optical potential (SCOP) formalism [5-6] is introduced in this work to calculate the positron scattering total cross sections over a wide energy range from 1 to 5000 eV. In the present study, the interaction potential of the positron-target scattering system is developed under optical potential framework for the calculation of positron scattering total cross sections. Total ionization and positronium formation cross section by positron impact are also evaluated.

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