ABSOLUTE TOTAL CROSS SECTION MEASUREMENTS FOR INTERMEDIATE ENERGY ELECTRON SCATTERING ON ETHANE AND PROPANE

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This work is part of the research program in our laboratory, which aims the study of properties of atmospheric pollutants. Nowadays the atmosphere is highly influenced by petroleum products and its derivatives. The burning of petroleum derivatives in domestic use, in industry and mainly in automotive transport, releases daily in atmosphere enormous quantities of carbon and other elements in gaseous form, some them extremely dangerous to human health. The hydrocarbons are one of the five most important atmospheric contaminants, representing more than 90% of pollution problem. We perform experimental and theoretical determinations of Absolute Total Cross Section (ATCS) for electron scattering by ethane and propane, in the energy range from 20 to 500 eV. Experimental data were acquired with an apparatus assembled in our laboratory, which uses the linear transmission technique [1]. The apparatus is composed by an electron gun, a gas cell, an analyzer system composed by desaccelerating electrostatic lenses and a Cylindrical Dispersive Analyzer 127º (CDA 127º) and a Faraday cup. The TCS, $\sigma(E)$, to the fixed impact energie E, was obtained by the measurement of the transmitted electron beam intensities, with (I_p) and without (I_o) sample the gas cell, applying the Lambert-Beer relation: $\ln (I_p/I_o) = - PL\sigma(E)/kT$, where k is the Boltzmann constant, L is the length of the interaction region, P the absolute pressure in the cell and T is the sample temperature. The energy resolution in all measurements was 0,7 eV (FWHM) and the overall systematic uncertainty at the TCS was evaluated to be less than 5%. The theoretical determinations of Total Cross Sections, also in the 20 to 500 eV energy range, was calculated using the Additivity Rule (AR) [1,2] and the Born-Bethe approximation [3-5]. These results were compared with our experimental data and also, with theoretical results from the literature. As it is expect, the theoretical calculations employing the Born–Bethe approximation overestimates the Total Cross Sections values in this energy range.

References

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