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Measurements of Scattering Cross Sections for 5.895 keV Photons in Various Polymers

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Abstract : The total differential cross section for scattering of the 5.895 keV photons by various polymers has been measured at scattering angle of 135o. The experimental measurements were carried out using the energy dispersive setup involving annular source of the 55Fe radioisotope and a low energy germanium (LEGe) detector. The cross section values are measured for 20 polymer targets namely, Paraffin Wax, Polytetrafluoro ethylene (PTFE), Cellulose, Silicone oil, Polyvinyl alcohol (PVA), Polyvinyl purrolidone (PVP), Polymethyl methacrylate (PMMA), Kapton, Mylar, Chitosan, Polyvinyl chloride (PVC), Bakelite, Carbopol, Chlorobutyl rubber (CBR), Polyetylene glycol (PEG), Polysorbate-20, Nylon-6, Cetyl alcohol, Carboxyl methyl sodium cellulose and Sodium starch glucolate. The measurements were performed in vacuum so as to avoid scattering contribution due to air and strong absorption of low energy photons in the air column. In the present investigations, the geometrical factor and efficiency of the detector were determined by measuring the K x-rays emitted from the 22Ti and 23V targets excited by the Mn K x-rays in the same experimental set up. The measured scattering cross sections have been compared with the sum of theoretically calculated elastic and inelastic scattering cross sections. The theoretical elastic (Rayleigh) scattering cross sections based on the various form factor approximations, namely, non-relativistic form factor (NF), relativistic form factor (RF), modified form factor (MF), and MF with anomalous scattering factor (ASF) as well as the second order S-matrix formalisms, and the inelastic scattering differential cross sections based on the Klein-Nishina formula after including the inelastic scattering function (KN+ISF) have been calculated. The experimental results show fairly good agreement with theoretical cross sections.

Keywords : photon, polymers, elastic and inelastic, scattering cross sections
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