Electron Scattering By Silane

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The total electron scattering cross sections for SiH_4 molecule are important for understanding the behaviour of mono-silane plasma and for the deposition of hydrogenated amorphous silicone films [1,2]. Moreover, the scattering of electron by silane is an important process in low-temperature plasmas used for semiconductor processing and fabrication [3], space science, radiation physics and in the study of fundamental chemistry.

Wan et al. [4] measured the total scattering cross section of silane and its halogenated derivatives for electron energies 0.2 to 12 eV using an electron transmission spectroscopy. Using a straight type time-of-flight with a retarding-potential method (RP-TOF) Sueoka et al. [5] measured total scattering cross section in the energy range 1-400 eV. Zecca et al. [6] measured total scattering cross section in the energy range of 75-4000 eV. Szmytkowski et al. [7] measured total scattering cross section of SiH_4 employing transmission method in the energy range of 0.6 eV to 250 eV.

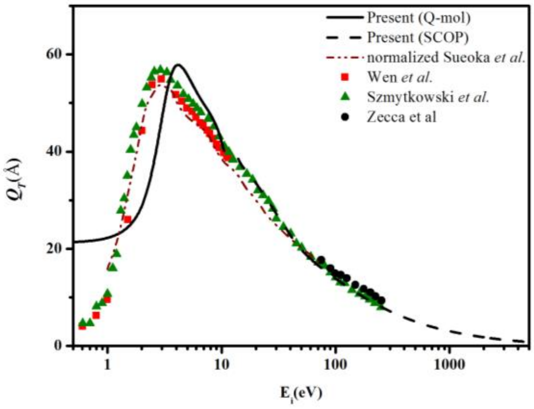

Figure 1 Present cross sections compared with the experimental results for e-SiH4 scattering. Solid line: present Q-mol; dash line: present SCOP; dash dot dot line: Sueoka et al. [5]; circles: Wen et al. [4]; triangles: Szmytkowski et al. [7] and circles: Zecca et al.[6].

As a step towards addressing the requirement of electron cross section data for this molecule over an extensive energy range we have employed two distinct formalisms for the calculation of total cross section. The ab initio R-Matrix [8] method for low energies and spherical complex optical potential (SCOP) [9] formalism for the intermediate to high energies.

The result shows very good agreement with the existing data. We have also calculated differential elastic and momentum transfer cross section up 20 eV by using ab initio R-matrix method [8] and found very good agreement with the previous data.

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