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Elastic Differential Cross Sections for Electron Scattering with Dichloromethane

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Synopsis In the present study joint experimental and theoretical elastic differential cross sections for electron scattering from dichloromethane in the incident electron energy region 7 to 50eV are discussed.

Dichlorotomethane (CH_2Cl_2) is a relevant atmospheric and environmental molecule, where its high volatility results from the constant use in chemical industries [1], in biomass production [2] as well as from oceanic emissions [3]. Once in the stratosphere, the main sink mechanism has been attribute to photolysis leading to chlorine radical formation. Such radical at tropospheric altitudes further acts as a catalyser to ozone fragmentation into ClO.
Photolysis [4], photoabsorption [5] and DEA [6] studies can be found in the literature, but only a few related with electron scattering processes and even those are in the high energy regime [7] or strictly theoretical approaches [8, 9].

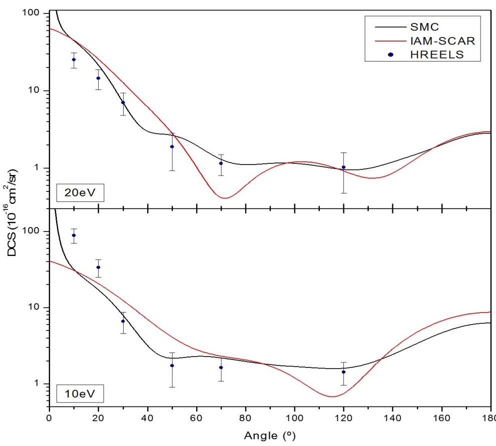

Figure 1. Elastic DCS for electron scattering from CH_2Cl_2 at 10 and 20 eV electron impact energy.

Here we present a comprehensive joint experimental and theoretical study on differential cross sections (DCSs) for elastic electron scattering from CH_2Cl_2 molecule for incident electron energies 7, 10, 20, 30 and 50 eV. The experimental DCSs were obtained in a High Resolution Electron Energy Loss Spectrometer (HREELS) [10] with an energy resolution of 120 meV (FWHM). The theoretical calculations were performed with two different methodologies: the Schwinger Multichannel Method (SMC) implemented with pseudopotentials [11] and the Independent Atom Method with Screening Corrected Additivity Rule (IAM-SCAR)[12]. The SMC method presents a better description of the elastic scattering at lower electron impact energies (up to 20eV), where the Born Closure correction for long range potentials gives a good description of the dipolar cross section dependence for smaller scattering angles. The IAM-SCAR method shows a better description for electron impact energies above 20eV.

The excellent agreement between experimental DCSs and both theoretical approaches leads to a good description of the shapes and angular distribution of the cross sections.

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References

[1] K. F. Alcantara *et al.* 2011 *J. Phys. B* **44** 165205
[2] J. M. Lombert *et al.* 1999 *J. Geophys. Res.* **104** 8373
[3] M. A. K. Khalil in *Reactive halogen compounds in the atmosphere* Springer; 1999. **4E** p. 45-79
[4] M. Yen *et al.* 1993 *J. Chem. Phys.* **99** 123
[5] A. Mandal *et al.* 2014 *J. Quant. Spec. Rad.* **149** 291
[6] G. A. Gallup *et al.* 2011 *J. Chem. Phys.* **135** 134316
[7] C. G. P. Karwasz *et al.* 1999 *Phys. Rev. A* **59** 1341
[8] A. P. P. Natalense *et al.* 1999 *Phys. Rev. A* **59** 879
[9] R. Naghma *et al.* 2014 *J. Elec. Spec. Rel. Phen.* **193**48
[10] F. MotteTollet *et al.* 1992 *J. Chem. Phys.* **97** 7314
[11] R. F. da Costa *et al.* 2015 *Eur. Phys. J. D* **69** 159
[12] F. Blanco *et al.* 2013 *Eur. Phys. J. D* **67** 199