Journal of Physics: Conference Series

Low energy elastic electron scattering from benzonitrile (C_6H_5CN)

Low energy elastic electron scattering from benzonitrile (C_6H_5CN)

G Tatreau [1], B Diaz[1], F Alharthi[1], M Zawadzki[1,2]* and M A Khakoo[1]†

[1]Department of Physics, California State University, Fullerton, California 92831, USA
[2]Atomic Physics Division, Department of Atomic, Molecular and Optical Physics, Faculty of Applied Physics and Mathematics, Gdańsk University of Technology, ul. Gabriela Narutowicza 11/12, 80-233 Gdańsk, Poland

Synopsis We present experimental differential elastic scattering cross sections (DCSs) for low energy electron scattering from benzonitrile along with integral and momentum-transfer cross sections that are determined from these DCSs. The measurements of DCSs are obtained using the relative flow method with helium as the standard gas, in a crossed electron-molecular gas beam arrangement. Our measurements are made at incident electron energies in the range of 1 − 30 eV and scattering angles in the range of (10°-130°).

Recently, in many previous theoretical and experimental electron collision studies the molecular targets containing a ring structure were of great interest due to its relevance in many fields, i.e. medicine, biology and bio-physics [1]. In present work we focus on providing the experimental insight into integral cross sections (ICSs) and momentum transfer cross sections (MTCSs) for benzonitrile.

This aromatic organic compound is a phenyl group bonded to a cyanide group (see figure). Such configuration, where a triple CN bond is present is very interesting from electron-molecule interaction point of view in terms of electron attachment to a system different from a C=C bond commonly found in organic compounds.

Our apparatus consists of a high energy-resolution electron gun/analyzer system, both are equipped with double hemispherical energy selectors to provide well-defined electron beam energy profiles and finesse. Typical electron currents ranged around 19-26 nA, with a corresponding energy resolution of between 40 and 55 meV, full width at half maximum. The experimental setup is located in a magnetically shielded vacuum chamber with a base pressure of 10^{-8} torr.

In order to evaluate ICSs and MTCSs for benzonitrile we performed series of measurements of elastic differential cross section (DCS) for a range of scattering angles (10°-130°) and energies (1 eV to 30 eV). ICSs and MTCSs were calculated from the measured DCS by extrapolating the DCS to 0° and 180° and applying standard numerical integration methods to them. Each DCS set was extrapolated to 0° and 180° by a polynomial curve [2]. The present results are presented in Fig. 1; both the behavior of the elastic ICSs and MTCSs, indicate a possible resonance located around 3.5 eV.

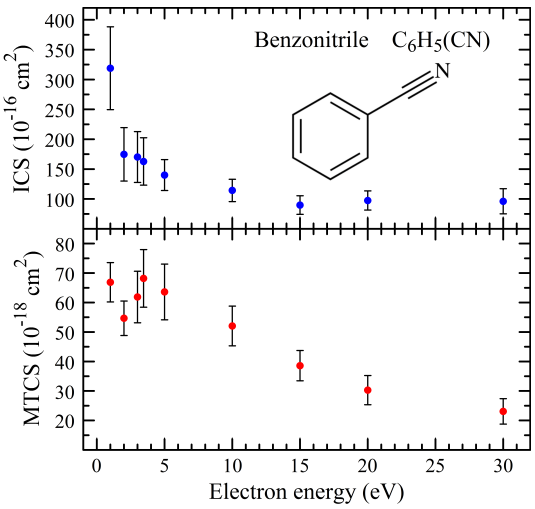

Figure 1. ICSs and MTCSs for elastic electron scattering by benzonitrile.

Acknowledgments: The work carried out at California State University, Fullerton was funded by the National Science Foundation under grant NSF-RUI-PHY 1606905 and by a Fulbright Fellowship to M Zawadzki.

References

[1] Gorfinkiel J D and Ptasinska S 2017 *J. Phys. B: At. Mol. Opt. Phys.* **50** 182001
[2] Fedus K, Navarro C, Hargreaves L R, Khakoo M A, Silva F M, Bettega M H F, Winstead C and McKoy V 2014 *Phys. Rev. A* **90** 032708

*E-mail: mateusz.zawadzki@pg.edu.pl
†E-mail: mkhakoo@fullerton.edu