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# Total electron scattering cross section measurements of Xe utilizing the threshold photoelectrons as an electron beam source

Manabu Kurokawa[1], Masashi Kitajima[1*], Hirotomo Kawahara[2], Hidetoshi Kato[2], Masamitsu Hoshino[2], Takeshi Odagiri[1], Hiroshi Tanaka[2], and Kenji Ito[3]
[1]Department of Chemistry, Tokyo Inst. Tech., Meguro-ku, Tokyo 152-8551, Japan
[2]Department of Physics, Sophia Univ., Chiyoda-ku, Tokyo 102-8554, Japan
[3]KEK-PF, Tsukuba, Ibaraki 305-0801, Japan

## Introduction

The scattering of very low energy electrons by atomic and molecular targets are expected to be strongly dominated by quantum effects involving phenomena such as quantum interference, and to reveal new and unexpected behavior. Recently, experimental technique for measuring the total cross section of the electron-molecule collisions at very low energy of below a few hundred meV (a few thousand kelvin) was developed by Field *et al* [1]. In their technique, mono-energetic photoelectrons produced in the photoionization of atoms by monochromatized Synchrotron Radiation (SR) were used as an electron beam source, instead of using a conventional hot filament. The photoelectrons were collected with a weak constant filed applied across the photoionization region. The energy width of the electron beam depends on the spot size and the band width of the monochromatized SR, which are trade-off between the photon flux of the excitation photon beam.

In order to achieve both high intensity and narrow energy width of the low energy electron beam, we have constructed a new setup, utilizing the threshold photoelectron produced by SR. Here we report total electron scattering cross section of Xe obtained by using the new electron beam source.

## The apparatus

The photon beam for the production of the threshold photoelectrons was provided by the synchrotron radiation source of the KEK-PF BL-20A. In the present technique, the penetration field was applied to correct only the "0" energy photoelectrons, instead of applying the constant filed across the photoionization region. The technique was developed as a highly efficient spectroscopic tool known as threshold electron spectroscopy [2]. In the penetrating field technique a potential well is formed in the interaction region by field penetration from the potential of an extraction electrode through a screening electrode. The potential well collects only the very low energy electrons over large solid angles (~ 4π sr) and forms an electron beam with very small emittance. Electron beam are focus into the collision cell filled with the target atoms and molecules. Total cross section for electron collisions with target were obtained by the beam attenuation method.

## Results

Figure 1 shows the total cross section of Xe up to 16eV obtained in the present work, together with previous experimental work. As can be seen in figure 1, the present results agree well with the previous work including the Ramsauer - Townsend minimum appeared in the low energy region below 1 eV. This agreement demonstrate that the apparatus was performing adequately in the energy ragion below 16 eV. A weak Fano type structure due to the Feshbach resonance of Xe was also clearly observed in the present results, which is shown in the insert of figure 1. The resonant structure of the Feshbach resonance of the total cross section of Xe has been obtained for the first time.

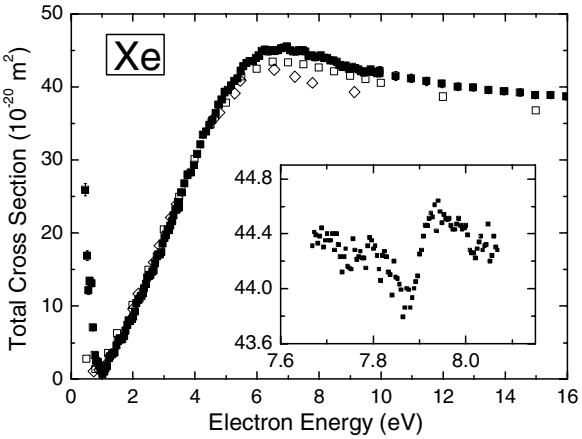


Fig. 1. Total cross section of Xe. ■;present work, □; Ref [3], ◇; Ref [4]. Blow up of the measured cross section at around of Feshbach resonance are shown in the insert.

## References

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* mkitajim@chem.titech.ac.jp