J. Phys. B: At. Mol. Opt. Phys. **24** (1991) 3045-3047. Printed in the UK

Momentum transfer cross sections for e^-–O_2 elastic scattering

S P Khare and Deo Raj

Department of Physics, Meerut University, Meerut 250004, India

Received 13 February 1991, in final form 19 April 1991

Abstract. The contribution of the differential cross section to the momentum transfer cross section from the large scattering angular region is shown to be quite significant.

Recently Iga *et al* (1987) measured elastic differential cross sections (EDCS) for e^--O_2 scattering over a wide angular range (5°-120°) for incident energies varying from 300 to 1000 eV. They have also integrated their EDCS with appropriate weight factors to obtain the total elastic cross section Q_{el} and total elastic momentum transfer cross section Q_M. However, they did not extrapolate their measured differential cross sections to 180° but instead truncated their integration at 120°.

Through this paper we wish to show that a significant contribution to Q_M comes from the larger scattering angles. To obtain theoretical values of Q_{el} and Q_M we have employed our (Khare and Raj 1982) previously calculated values of EDCS for e^--O_2 elastic scattering. These EDCS values were obtained in the independent-atom model (IAM) along with partial waves. The interaction potential for each atom was taken to be the sum of the static and dynamic polarization potential and the scattering amplitudes from the two atoms were added coherently. The anharmonic vibrational effects of the molecule were also included.

In table 1 we have compared the present values of Q_{el} and Q_M with those of Iga *et al* (1987). For a direct comparison we have shown two sets of the theoretical values. The first set has been obtained by taking the maximum value of the scattering angle to be 120°, the same as taken by Iga *et al.* However, the second set takes the normal maximum value of θ, i.e. 180°. It is evident from the table that our first set is in good agreement with the experimental values of Iga *et al.* However the values of Q_M shown

Table 1. Elastic integral and momentum transfer cross sections for e^--O_2 scattering (a_0^2). Set I is calculated taking the contribution of DCS up to 120°. Set II is calculated taking the contribution of DCS up to 180°.

	Integral			Momentum transfer		
	Present			Present		
E (eV)	I	II	Iga *et al* (1987)	I	II	Iga *et al* (1987)
300	10.2	10.7	10.3 ± 2.1	1.8	2.6	1.60 ± 0.32
400	8.3	8.5	9.08 ± 1.82	1.3	1.7	1.31 ± 0.26
500	7.1	7.2	7.15 ± 1.41	0.98	1.2	0.921 ± 0.184

in the second set are significantly higher than those given by Iga *et al.* At 300 eV the two values differ by about 30%. Even at 500 eV the difference is about 20%. On the other hand the difference between the experimental values of Q_{el} and the present values of the second set is only about 4%. Such behaviour is according to expectation. The integrand of Q_M contains an additional weight factor given by $(1-\cos\theta)$, which is quite important for the backward angles.

In figure 1 we have compared the values of EDCS previously obtained by us (Khare and Raj 1982) with the experimental data of Iga *et al.* The figure shows highly

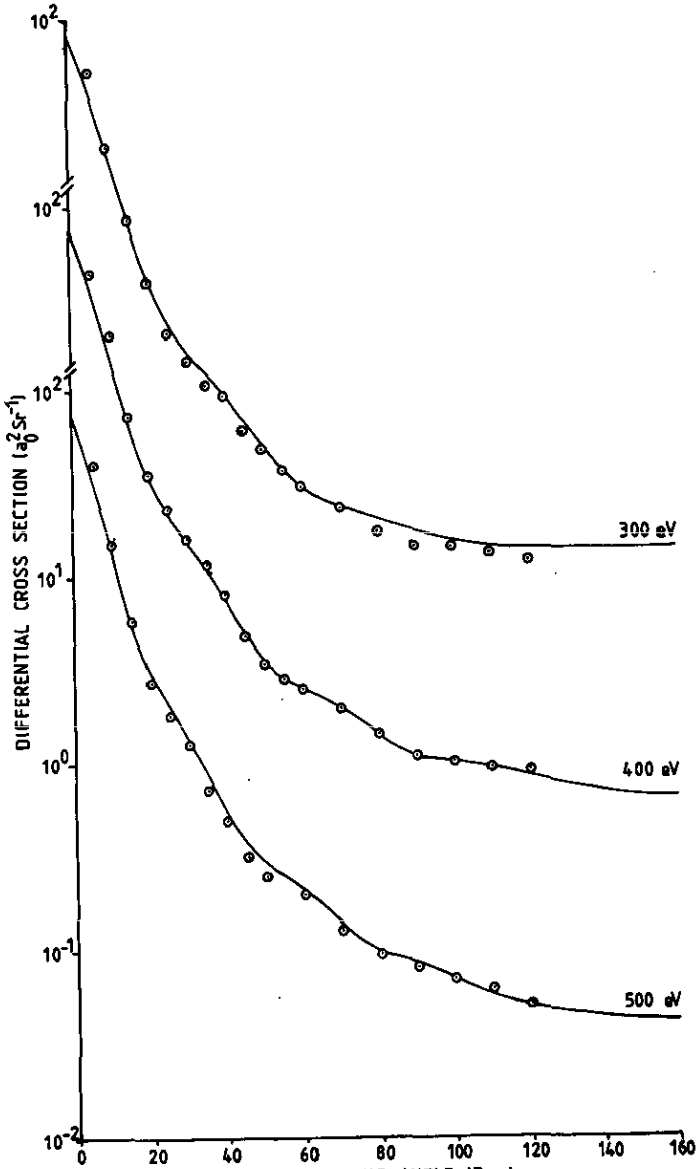

Figure 1. Differential cross section for e^{-}-O_2 elastic scattering at 300, 400 and 500 eV impact energies. ——, present results; ⊙, experimental data of Iga *et al* (1987).

satisfactory agreement between the theoretical and experimental values at all the incident energies and over the whole angular region, including large scattering angles. As shown earlier, our theoretical values are also in good agreement with the experimental data of Bromberg (1974) which are available only up to 40°.

Finally we conclude that for reliable values of the momentum transfer cross sections the contribution of the larger scattering angles must be included. Furthermore, since figure 1 shows a good agreement between the theory and the experiment over the whole angular and energy regions, the values of the momentum transfer cross sections given by set II of table 1 should be reliable.

Acknowledgment

One of us (DR) is grateful to the UGC for financial assistance.

References

Bromberg J P 1974 *J. Chem. Phys.* **60** 1717
Iga I, Tao L M, Nogueira J C and Barbieri R S 1987 *J. Phys. B: At. Mol. Phys.* **20** 1105
Khare S P and Raj D 1982 *Ind. J. Pure Appl. Phys.* **20** 538