

Electron-impact vibrational excitation of CO<sub>2</sub>  
– Recommended data on the cross section –

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An electron collision with CO<sub>2</sub> plays a fundamental role in many application fields (e.g., atmospheric physics, gaseous discharges, plasma processing etc.) Because of its long history, there are a large number of papers reporting cross section data for the process. It would be valuable, therefore, to compile those data to produce a set of cross sections recommended for use. Such an attempt has been made recently.<sup>1)</sup> Here, as an example, the result for the vibrational excitation is presented.

Very recently Kitajima et al. made a crossed-beam experiment to measure the differential cross section for the vibrational excitation of CO<sub>2</sub> at the angles of 10-130 deg and the energies of 1.5-30 eV.<sup>2)</sup> From the experimental data, supplemented with the recent theoretical calculation,<sup>3)</sup> integral cross sections have been derived to recommend. For the region of the energies below 1.5 eV, the result of a recent swarm-type measurement by Nakamura<sup>4)</sup> could be used. While the swarm results for (010) and (001) excitations are consistent with the recommended values in the higher-energy region, those for (100) are not smoothly connected with the higher-energy values. In 1985, Kochem et al. reported their beam-type measurement of DCS at the energies below about 1 eV.<sup>5)</sup> They succeeded in obtaining integral cross sections only for (100) excitation. Their cross section for (100) is consistent well with the values recommended above. The tentative conclusion for the recommended data below 1.5 eV is: cross sections from a beam-type measurement of Kochem et al. for (100) and the swarm data of Nakamura for (010) and (001). To confirm this conclusion, we need further theoretical and/or experimental studies.

1) Y. Itikawa, *J. Phys. Chem. Ref. Data* **31**, 749 (2002).

2) M.Kitajima, S.Watanabe, H.Tanaka, M.Takekawa, M.Kimura, and Y.Itikawa, *J. Phys. B* **34**, 1929 (2001).

3) M.Takekawa and Y.Itikawa, *J.Phys. B* **31**, 3245 (1998); **32**, 4209 (1999).

4) Y.Nakamura, *Aust. J. Phys.* **48**, 357 (1995).

5) K.-H.Kochem, W.Sohn, N.Hebel, K.Jung, and H.Ehrhardt, *J.Phys. B* **18**, 4455 (1985).