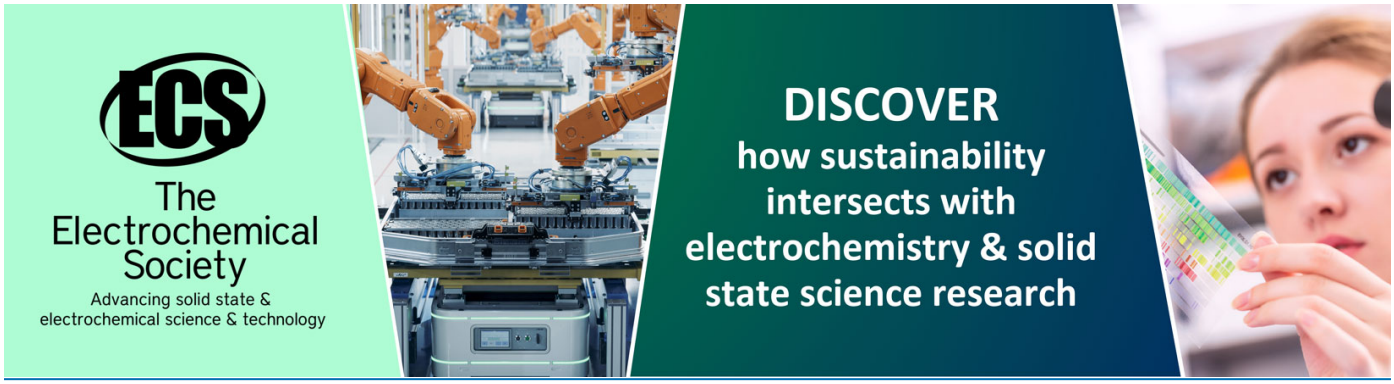
Generalized oscillator strengths of the valence-shell excitations of sulphur dioxide studied by fast electron impact



Generalized oscillator strengths of the valence-shell excitations of sulphur dioxide studied by fast electron impact

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Synopsis Generalized oscillator strengths (GOSs) of the valence-shell excitation of sulphur dioxide are of great importance for modeling the planet's atmospheric phenomena and astronomical observations, which are determined at an incident electron energy of 1.5keV in this work. The present GOSs are helpful to assign the experimental spectra and explore excitation dynamics.

Sulphur dioxide is an important constituent of the interstellar medium and the atmospheres of Venus and Jupiter's satellite Io. Sulfur cycle is one of the main chemical processes in the atmosphere of Venus and Mars [1, 2]. Besides, sulphur dioxide is a key component of tropospheric and stratospheric aerosols and acid rain. Therefore, the valence-shell excitations of sulfur dioxide have attract extensive interests spanning more than eight decades. However, the dynamic parameters of the valence-shell excitations of SO_2 have not been paid enough attention, and this is what we want to do in this work. Using the fast electron energy loss spectroscopy, the GOSs of the valence-shell excitations of SO_2 have been measured in this work at an incident electron energy of 1.5keV and an energy resolution of 70meV. The present GOS for the $\widetilde{C}+\widetilde{D}$ excitation of SO_2 is illustrated in Fig.1. It is obvious that the GOS of $\widetilde{C}+\widetilde{D}$ states shows a typical momentum transfer dependence behavior of a dipole-allowed transition, i.e., the GOS decrease with the increasing of the squared momentum transfer. It is also noticed that the GOS has a minimum at about 2 a.u.. Furthermore, the GOSs for other valence-shell excitations have also been obtained.

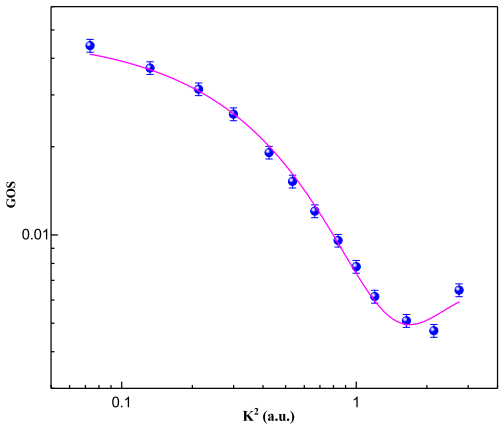

Figure 1. The GOSs for the $\widetilde{C}+\widetilde{D}$ excitations of SO_2. The blue dots are the present GOSs. The Megenta line are fitting curve.

In summary, the GOSs of the valence-shell excitations of sulphur dioxide have been determined by a fast electron impact method, and the present GOSs can serve as basic data to modeling planetary atmospheric phenomena and evolution of the atmosphere of the early Earth.

References

[1] Farquhar J *et al* 2000 *Nature* **404** 50
[2] Mills F P *et al* 2007 *Geophys. Monogr. Ser.* **176** 73

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