

The ionization and dissociation of nitrous oxide studied by fast electron impact

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Synopsis Using the high-resolution fast electron energy loss spectrometer, the generalized oscillator strength densities (GOSDs) of the ion fragments of N_2O at different momentum transfers were determined at a high resolution (80meV), and the momentum transfer dependence behavior of the ionization and dissociation of N_2O has been studied.

N_2O is one of six greenhouse gases in the *Kyoto Protocol*. Compared with CO_2 , the percentage of N_2O in the Earth's atmosphere is very low, but its greenhouse effect is many times stronger than that of CO_2 . N_2O has a long lifetime in the Earth's atmosphere, and can be transported to the stratosphere leading to ozone depletion. N_2O is a non-symmetric linear triatomic molecule and is the bridge between diatomic molecules and polyatomic molecules, which also attracts the attention of many theoretical physicists and quantum chemists. N_2O is involved in a variety of physical and chemical processes, so that its ionization and dissociation processes induced by photoabsorption or electron impact are very important.

The generalized oscillator strength densities of the ion fragments of N_2O measured at an impact energy of 2.5keV and scattering angles of 0° and 2° are shown in Figures 1 and 2, and the corresponding excited states are assigned. The present results are normalized to our previous measurement at 21eV [1]. Figure 1 shows

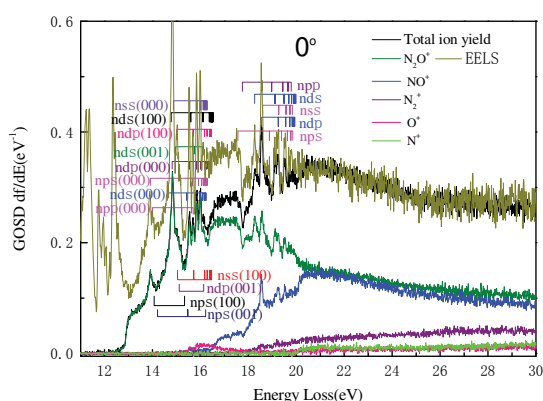


Figure 1. The GOSDs of the ion fragments at 0°

that the appearance potential of N_2O^+ is 12.77eV, which corresponds to its ionization energy. NO^+ appears at 16.06eV, and this result is in agreement with that of Berkowitz *et al* [2], but higher than that of Kinmond *et al* [3]. In Figure 1, we can also see the O^+ appears at 15.2eV, and this result is in agreement with that of Kinmond *et al* [3].

The GOSDs of the ion fragments at 2° are shown in Figure 2. Through the comparison with Figure 1, we can see that all the ion fragments increase with the increasing of the scattering angle in the energy region of 24-30eV. The superexcited states of $6\sigma^{-1}\text{nd}\sigma$ mainly dissociate to N_2O^+ channel, and the percentage of dissociating to N_2O^+ and NO^+ channel of $6\sigma^{-1}\text{nd}\pi$ is nearly same [1].

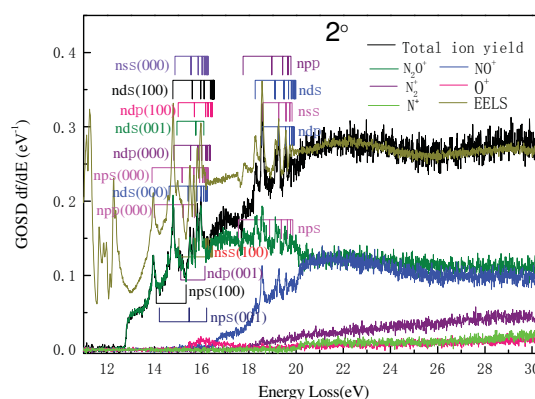


Figure 2. The GOSDs of the ion fragments at 2°

References

- [1] Y Y Wang *et al* 2010 *J. Chem. Phys.* **132** 124301
- [2] J Berkowitz *et al* 1977 *J. Chem. Phys.* **67** 2740
- [3] E Kinmond *et al* 1999 *Int. J. Mass. Spectrom.* **185** 437

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