

About the Double Ionization of NH_3 and CO_2 .

A Comparison between Photoionization and Electron Impact.

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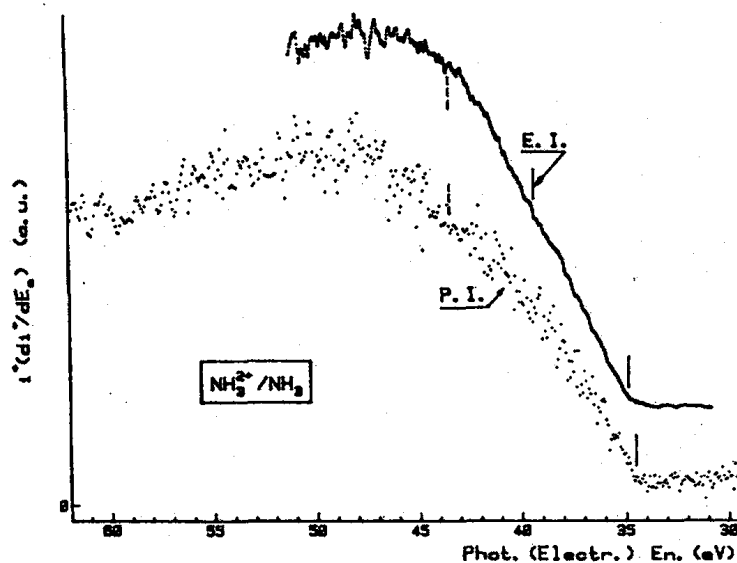
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Recently the ionization efficiency curve of $\text{NH}_3^{2+}/\text{NH}_3$ as well as the dissociative ionization of NH_3 into N^{2+} have been investigated by electron impact /1/. Samson et al. /2/ published the photoionization cross section for NH_3^{2+} production down to 34 nm, i.e. 36.46 eV. No double ionization energy has been determined.

The photoionization of NH_3 into NH_3^{2+} has been measured by using synchrotron radiation dispersed by a TGM-monochromator in the wavelength region of 20-45 nm. Though of very low intensity, the NH_3 ion current could be recorded with an acceptable signal-to-noise ratio at least in the threshold region (see fig.1). For comparison the earlier published /1/ first differentiated electroionization efficiency curve of NH_3^{2+} is reproduced in the same figure. Good agreement is found between both experiments.

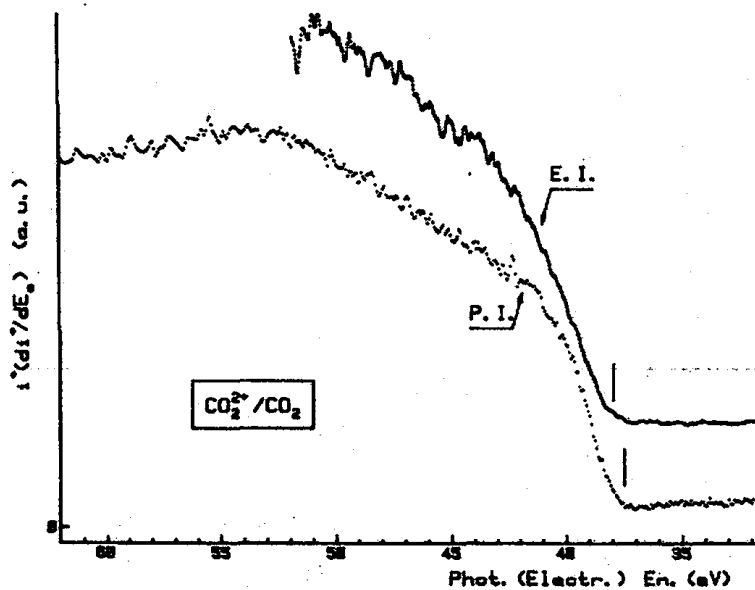
Fig.1. Ionization efficiency curve of $\text{NH}_3^{2+}/\text{NH}_3$: E.I. electron impact, P.I. photoionization.



By linear extrapolation of the first derivative of the electroionization efficiency curve, an ionization energy of 34.8 ± 0.2 eV was determined /1/. By photoionization the threshold

corresponding to the lowest double ionization energy of NH_3 , measured by the same method, is at 34.5 ± 0.1 eV. Though a slide discrepancy of 0.3 eV, both measurements disagree with the electron impact measurement of Dorman and Morrison /3/, i.e. 33.7 ± 0.2 eV and 36.8 eV.

Fig.2. Ionization efficiency curve of $\text{CO}_2^{2+}/\text{CO}_2$: E.I. electron impact, P.I. photoionization



In the frame of a dissociative electroionization work on CO_2 , still in progress, its double ionization has been investigated by both electron impact and photoionization. The results are shown in fig.2.

By photoionization the lowest onset for CO_2^{2+} formation is 37.5 ± 0.1 eV. By linear extrapolation this onset is observed at 38.0 ± 0.1 eV. By electron impact and using the latter method, the double ionization energy of CO_2 is measured at 38.0 ± 0.2 eV.

The present results markedly disagree with previous determinations. Samson et al. /4/ using synchrotron radiation published an onset of 36.2 ± 0.4 eV, whereas Dorman and Morrison /3/ measured a threshold at 36.4 ± 0.4 eV by electron impact. Much better agreement is found with Moddeman et al. /5/ who measured the lowest double ionization energy of CO at 37.8 ± 0.3 eV by Auger electron spectroscopy.

References

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