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ION TRANSLATIONAL ENERGY DISTRIBUTIONS FROM INNER-SHELL DISSOCIATIVE IONIZATION OF N_2O, NH_3 AND SF_6.

R. LOCHT[1], B. LEYH[1], H.W. JOCHIMS[2], W. DENZER[2], H. BAUMGÄRTEL[2].

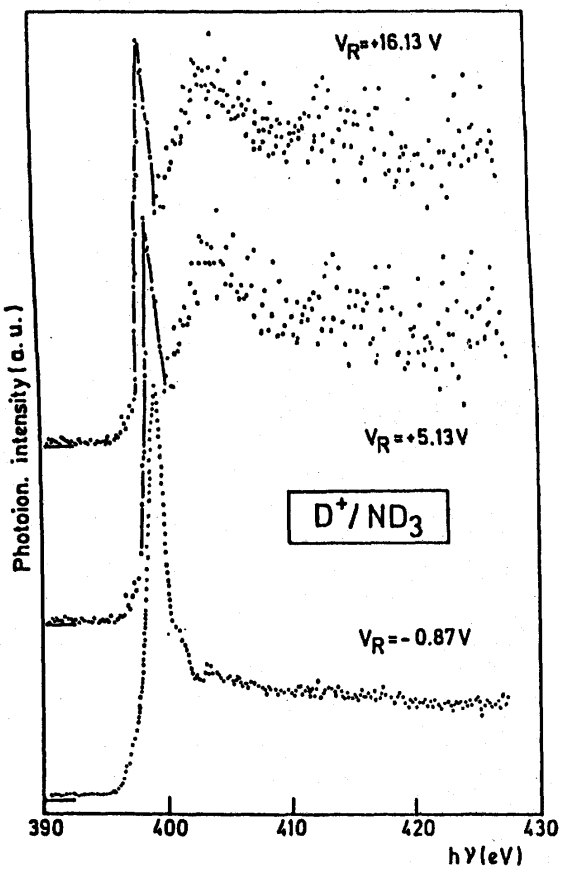
[1] *Département de Chimie Générale et de Chimie Physique, Bât.B6, Université de Liège, Sart-Tilman par B-4000 Liège 1, Belgium*
[2] *Institut für Physikalische und Theoretische Chemie, Freie Universität Berlin, Takustrasse 3, W-1000 Berlin 33.*

We recently published a work devoted to the investigation of the translational energy distribution of N^+/N_2 in the inner-shell ionization region, as measured by synchrotron radiation /1/ and using the IRPD-technique. N^+ ion yield curves for translational energy-selected ions were obtained. These results compare favourably to those obtained by PEPICO and PIPICO techniques /2/.

To pursue our effort to investigate the dynamics of unimolecular decay at inner-shell ionization energies, we investigated the dissociation of polyatomic molecules, i.e. N_2O, NH_3 and SF_6 in their various decay channels. The experimental setup used here is quite similar to that used earlier. The retarding potential method is used for the ion energy analysis. The present measurements being still running, only preliminary results will briefly be reported here.

All the fragments observed in the mass spectrum of N_2O recorded at 427 eV have been investigated, i.e. NO^+ , N_2^+ , O^+, N^+ and N^{2+} . The ion yield curves, as well as the ion kinetic energy distributions for different wavelengths (398 eV, 401 eV and 430 eV) were recorded. Owing to a mirror defect, the Oxygen K-edge energy range was not accessible.

Figure 1



The ion energy distribution of NO^+/N_2O is rigorously constant for the σ-π^* transitions at 398 eV and 401 eV. Energetic (but low intensity) NO^+ ions of up to about 4 eV were detected. Contrarily, at 430 eV (shape resonance) two components of about equal intensity, are observed. The high energy distribution extends to about

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10 eV translational energy. Exactly the same features are observed for N_2^+ and N^+. However, the latter ion showed a distribution by far exceeding 10 eV for 430 eV photons. This is also the case for O^+ and N_2^+. Whereas 0^+ shows a marked difference in the energy distribution recorded at 398 eV and 401 eV, at 430 eV both the O^+ and N^+ ion show a major contribution of very high translational energy (» 10 eV).

The dissociative single and double ionization of NH_3 (ND_3) being investigated in the valence ionization energy range, it was interesting to examine these phenomena in the inner-shell ionization energy range. The most intense fragments in the mass spectrum recorded with 430 eV photons are N^+, $NH(D)^+$, $NH(D)_2^+$, and $NH(D)_3^+$. The $H(D)^+$, N^{2+} and $NH(D)_2^{2+}$ are also observed. The most surprising feature for all ions, except $H(D)^+$, is that their kinetic energy distribution is quasi purely thermal at any photon energy. This is in sharp contrast with our observations in the valence ionization energy range.

However, as expected, $H(D)^+$ carries large amounts of translational energy and the distribution would probably exhibit three components at 401 eV. Fig. 1 shows ion yield curves of D^+/ND_3 recorded for different retarding potential settings (0 eV, 2.6 eV and 16.6 eV).

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