

THE VACUUM UV PHOTOABSORPTION SPECTRA OF THE THREE DICHLOROETHYLENE ISOMERS

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In the frame of our project related to the investigation of the halogenated ethylenes, we already reported on the spectroscopy of monofluoroethylene (vinylfluoride), 1,1-difluoroethylene (vinylidene fluoride) [1] and monochloroethylene (vinylchloride) [2]. In these reports the photoabsorption spectrum, the threshold photoelectron spectrum and the Constant Ion State spectra (CIS) were described.

In the present work we report on the investigation of the photoabsorption spectra of the 1,1-, cis 1,2- and trans 1,2-dichloroethylene. Obtaining these data proved to be essential for the interpretation of the threshold photoelectron spectra and the CIS-spectra [1,2]. The present photoabsorption work was performed on the 1.5m-NIM-I beamline at the synchrotron radiation facility BESSY. A modified McPherson Im-NIM monochromator was used [3]. The gas under investigation was expanded in an absorption cell at controlled sample pressure. The entrance and exit slits were adjusted at 100 μ m. The light is dispersed on a 1 200 μ /mm grating. All the absorption spectra have been recorded between 5 eV and 20 eV photon energy.

The photoabsorption spectrum obtained for the three above mentioned compounds are displayed in fig. 1-3. Excepting fig.3, related to 1,1-dichloroethylene, the two other spectra are shown between 5-20 eV photon energy. Previous spectroscopic observations [4] were restricted to 5-9 eV photon energy.

In the three photoabsorption spectra, the spectral region below 9 eV displays a more or less structured broad band, extending from 5-8 eV photon energy and centered at 6.4 eV in the 1,1- isomer and on 6.6 eV in the 1,2-compounds. Above 8 eV, the 1,1-isomer exhibits an abundant but very weak fine structure extending between 7.5-9 eV. Contrarily, the 1,2-isomers both show weak to strong sharp peaks between 8-9 eV photon energy.

These features are ascribed to the first members of the π -ns and np Rydberg series converging to the first ionization limit [4]. The vibrational fine structure of these states could be observed. The ionization energy has been measured by threshold photo-electron spectroscopy. Between 5-8 eV the observed structures are superimposed on the typical ethylenic π - π^* transition centered at about 6.5 eV.

The 9-20 eV spectral region exhibits strong differences between the three isomers and these structures are more specific. Up to about 11.5 eV sharp and/or strong structures are observed, converging to the 2nd-4th ionization energies. The energy range between 11.5-20 eV is mainly dominated by broad resonances which have probably to be assigned to members of Rydberg series converging to higher lying ionic states. The underlying increasing background has to be ascribed to valence-to-virtual valence transitions.

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Fig. 1: The photoabsorption spectrum of *cis* 1,2-dichloroethylene between 5-20 eV photon energy.

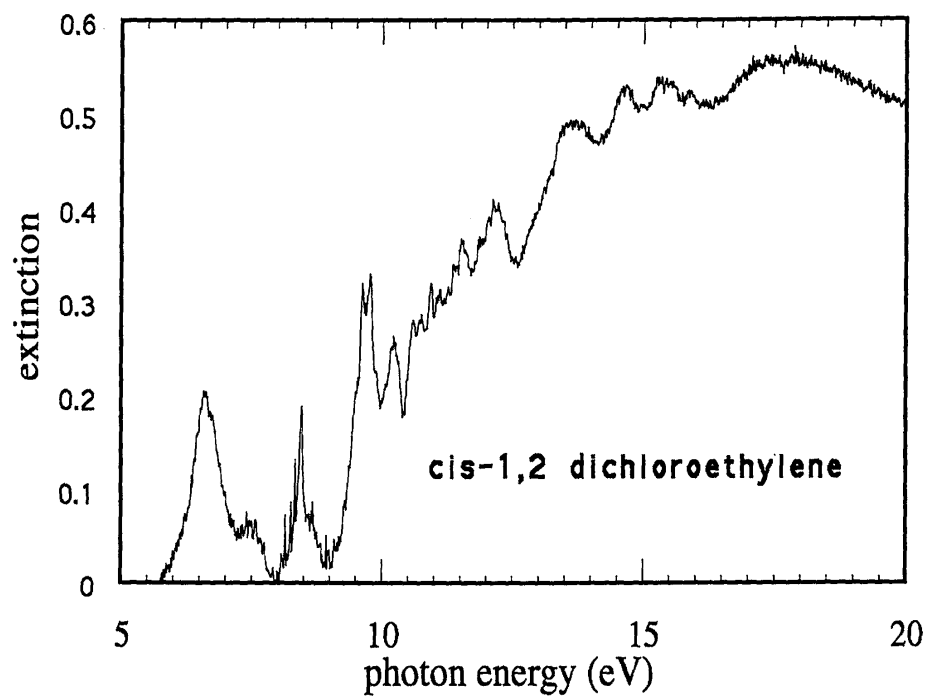


Fig. 2: The photoabsorption spectrum of *trans* 1,2-dichloroethylene between 5-20 eV photon energy

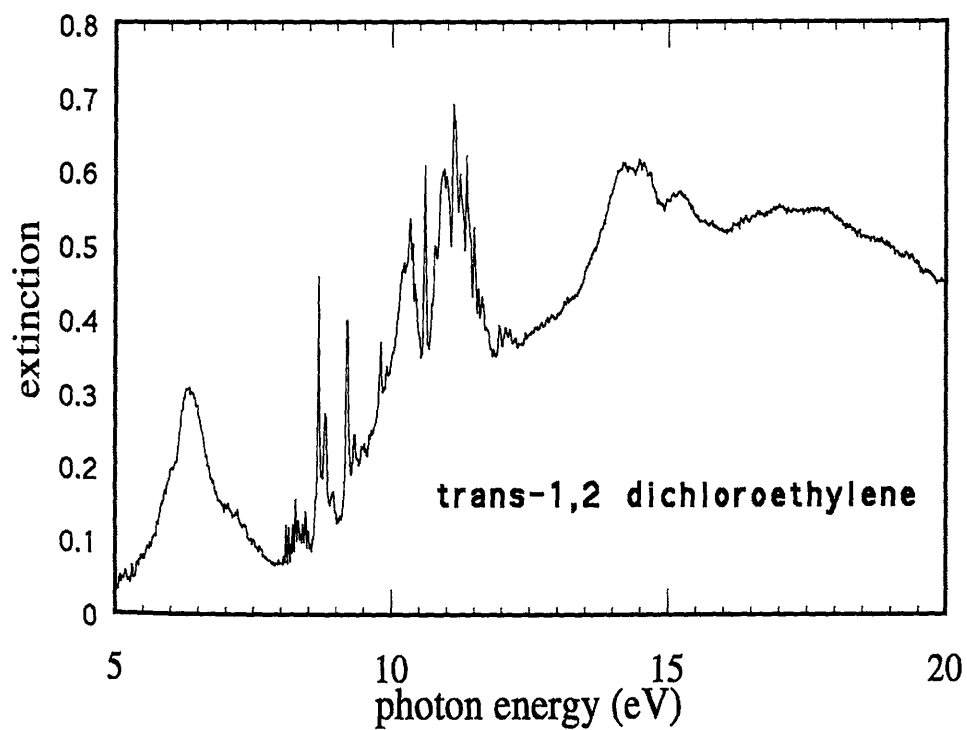
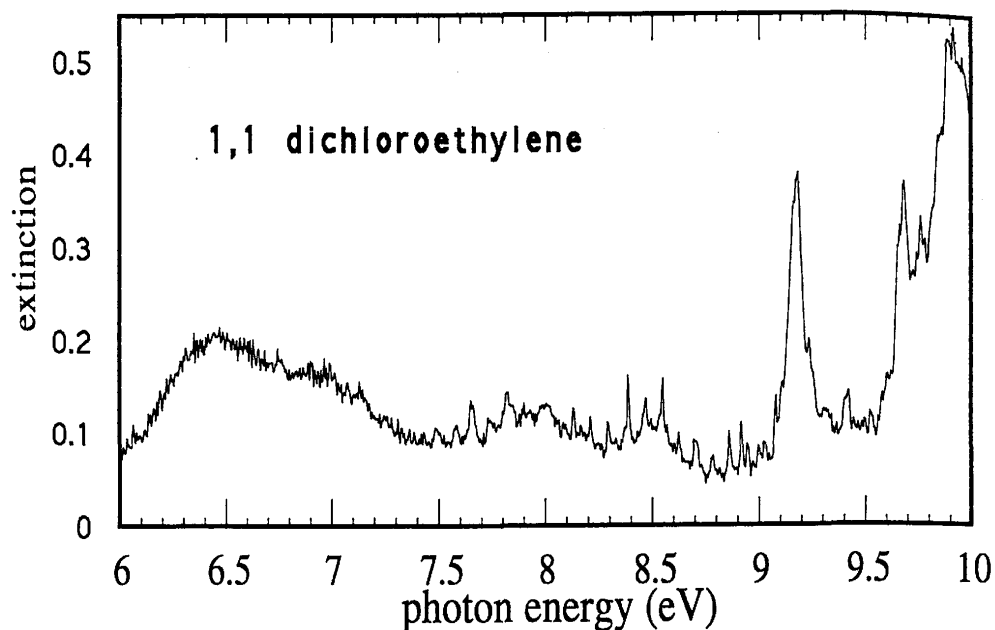


Fig. 3: The photoabsorption spectrum of 1,1-dichloroethylene between 6-10 eV photon energy.



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