

# Dissociative electron attachment to gas phase valine

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Low energy electron attachment to gas phase L-valine;  $(\text{CH}_3)_2\text{CHCH}(\text{NH}_2)\text{COOH}$ , is studied in the energy range from several meV to 14 eV. The experiments are carried out with a crossed electron/molecule beams apparatus where a monochromatic electron beam is formed using a trochoidal electron monochromator (TEM). With this setup an electron energy resolution of about 50 meV can be achieved, however, for higher sensitivity the present measurements were performed with a resolution of 150 meV. The monochromatic electron beam is crossed with a molecular beam of gas phase valine that is formed by subliming valine in a heatable molecular beam source (EMBS) with an effusion channel that is 0.5mm in diameter and 4 mm long.. In order to achieve sufficient vapour pressure the EMBS is maintained at a temperature of 413 K. In the intersection zone, where the molecular beam crosses the monochromatic electron beam negative ions are formed. The negative ions are extracted by a weak electric field into a quadrupole mass filter and the mass selected negative ions are detected as a function of the electron energy.

Like in the case of the previously studied amino acids glycine and alanine no parent ion formation by free electron attachment to valine is observed. The interaction of low energy electrons with gas phase valine is purely dissociative, leading to the formation of a number of fragments through three distinct resonances. The most pronounced of these fragments is the molecular ion that has lost one hydrogen  $(\text{M-H})^-$ . This fragment is predominantly formed via a low energy resonance, reflected in the ion yield curve by an intensity maximum at about 1.2 eV. In addition to  $(\text{M-H})^-$  the fragment  $(\text{M-OH})^-$ ,  $\text{COOH}^-$ ,  $\text{OH}^-$  and  $\text{CN}^-$  also show maxima at low energies, i.e. resonances at sub excitation energies, located between 1.5 and 2 eV. This low energy resonance is attributed to a transient negative ion (TNI) formed through electron attachment to the unoccupied  $\pi^*$  orbital of the  $-\text{COOH}$  group.

Core excited resonances are also observed in electron attachment to valine around 5.5-6 eV and around 8-9 eV. The former appears only through  $(\text{M-H})^-$ ,  $(\text{M-OH})^-$ ,  $\text{COOH}^-$  and with low intensities through the  $\text{CN}^-$  and the  $\text{OH}^-$  formation. The origin of this resonance is explained as a  $\pi-\pi^*$  transition, i.e., HOMO-LUMO; one-hole two-particle resonance. The later contribution is visible to some extent in all ion yield curves except for  $(\text{M-H})^-$ . In addition a contribution close to 0 eV is observed in the  $\text{COOH}^-$  and  $\text{OH}^-$  ion yield curves. [odduring@hi.is](mailto:odduring@hi.is)

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