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Electron-impact ionization mass-spectrometry of molecules and clusters in a pulsed helium droplet source SHENGFU YANG, SCOTT BRERETON, ANDREW M. ELLIS, University of Leicester, UK — A pulsed helium droplet source has been developed and characterized. The nozzle geometry was found to be critical in allowing controlled tuning of helium nanodroplet size by variation of the stagnation pressure and temperature. The average droplet size scales according to a simple $\{p,T\}$ scaling law, placing pulsed helium nanodroplet sources on a par with cw sources for the first time. Using this pulsed source, the ability of helium nanodroplets to impede ion fragmentation in electron impact mass spectrometry has been explored. A number of haloalkanes and C_1–C_6 alcohols were selected as the target species. The presence of helium alters the fragmentation patterns when compared with the gas phase, with some ion product channels being more strongly affected than others. Parent ion intensities are also enhanced by the helium for alcohols, but only for the two cyclic alcohols studied, cyclopentanol and cyclohexanol, is this effect large enough to transform the parent ion from a minor product (in the gas phase) into the most abundant ion in the helium droplet experiments. The results obtained are difficult to explain solely by rapid cooling of the excited parent ions by the surrounding superfluid helium, although this undoubtedly takes place. A second factor also seems to be involved, a cage effect which favors hydrogen atom loss over other fragmentation channels.

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