LASER-INDUCED FLUORESCENCE SPECTROSCOPY OF JET-COOLED LASER-DESORBED PHTHALOCYANINES

F.L. PLOWS , A.C. JONES , *Department of Chemistry, The University of Edinburgh, West Mains Road, Edinburgh, EH9 3JJ, UK..*

Supersonic jet spectroscopy is limited conventionally by the thermal stability of the molecules under investigation. The molecules of interest are heated and the resultant vapour mixed with the carrier gas. This method has the drawback that only small and/or thermally stable molecules may be studied. Laser desorption, in contrast, utilises an infra-red laser pulse to desorb thermally labile molecules directly into the gas phase. This allows a greater range of molecules to be investigated using the technique of jet cooling.

A special desorption nozzle is used in the supersonic jet apparatus to interface the desorption and collisional cooling processes. Molecules can thus be desorbed directly into the path of the pulsed supersonic jet such that they are entrained in the jet carrier gas and cooled. These cold and isolated molecules may then be investigated spectroscopically, as in a conventional free jet, using laser-induced fluorescence (LIF).

We are currently investigating a series of metallophthalocyanines. The phthalocyanines serve as synthetic models for the porphyrins, a biologically important family of molecules which include chlorophyll and haemoglobin. Little detailed spectral information is currently available for these molecules. We have shown that these large molecules can be successfully laser-desorbed and jet-cooled and report on the LIF spectra of several phthalocyanines. The vibronic structure of these spectra is sensitive to deviations from planar symmetry. In the case of magnesium phthalocyanine, there is evidence for the existence of two conformers: one planar and one in which the magnesium atom lies out of the plane of the macrocycle. This is of interest in relation to the proposed stereochemical mechanism of oxygenation of haemoglobin which involves shifts of the metal atom (iron) relative to the plane of the porphyrin macrocycle.