THE MIRCOWAVE SPECTRA OF GaNC AND GaCN, AND THE GEOMETRIES OF THE GROUP 13 CYANIDES

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The microwave spectra of six isotopmers of gallium isocyanide, GaNC, and of three isotopmers of gallium cyanide, GaCN, have been measured in the frequency region 6-26 GHz, using a pulsed jet cavity Fourier transform microwave spectrometer. The samples were prepared by ablating solid Ga with the second harmonic of a pulsed Nd:YAG laser and reacting the Ga vapour with cyanogen or, in the case of artifically labelled samples, acetonitrile. Both molecules are linear, and their rotational constants, centrifugal distortion constants, and Ga and N hyperfine constants have been obtained. The geometries of the two molecules have been determined using the rotational constants, and are compared with the geometries of the corresponding In and Al derivatives. The latter have been obtained partly using the spectra of AlCN and $Al^{15}NC$, which are also reported here for the first time. The isotopic data would appear to indicate that the molecules have abnormally short CN bonds. A possible reason for this phenomenon will be presented.