Raman Spectrum of Gaseous Tin(II) Chloride

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Summary The first vibrational spectrum of a discrete, monomeric, bent MX_2 species (where $X =$ halogen) is reported.

THE Raman spectrum of tin(II) chloride was obtained using 5145 Å laser excitation of one atmosphere of compound contained in a silica ampoule at 650°. The spectrum (Figure) is consistent with a bent molecule. Two of the predicted three bands for a C_{2v} point group were observed, both of them being polarised. The (less intense) asymmetric stretch was probably obscured by the peak assigned to the symmetric stretch. Linear metal dihalides (*e.g.* zinc chloride) have been observed to give only one polarised band in the Raman spectrum, in agreement with prediction.[1] Vapour density and electron diffraction studies[2,3] on tin chloride have shown that it is predominantly monomeric under the conditions used in these experiments; it was thought that the molecules were bent, but the valence angle was not determined.

Due to extensive polymerisation, the observed Raman spectra of solid and molten tin chloride are quite different to the gas phase spectrum.[4] The frequencies of vibration of discrete tin chloride molecules have been measured by chemiluminescent emission spectroscopy. However, the method is fraught with difficulty in the assignments of band progressions to particular molecular species, electronic states and vibrational modes, and only in one case is there good agreement with the frequencies obtained by the more direct method of this investigation (Table).

Vibrational mode	Calculated			Observed for a gas		
	Ref. 7	Ref. 5	Ref. 8	Ref. 5	Ref. 6	This work
ν_1	398	435	—	377	350±5	352±1s,p
ν_2	102	205	116	207	120±5	120±1m,p
ν_3	406	—	—	—	—	(356)

Solid		Melt
Ref. 4	This work	Ref. 4
193s	192sh	228s,p
	162s	
	125m	112s,p
90s	95sh	
	83s	

The vibrations are labelled according to convention, *i.e.*, ν_1, symmetric stretch; ν_2, deformation; ν_3, asymmetric stretch. Frequencies are quoted in wavenumbers (cm.$^{-1}$); p denotes polarised.

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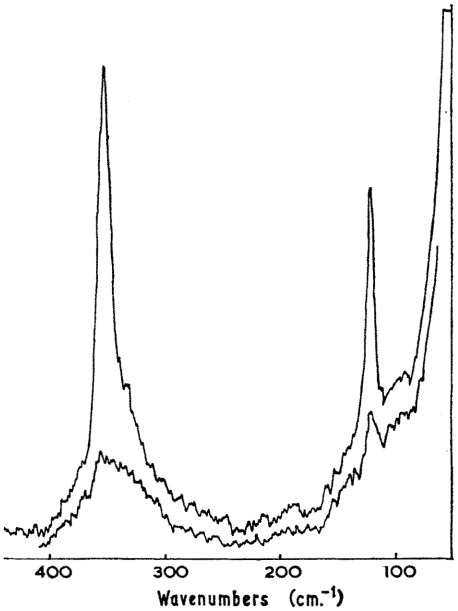

FIGURE

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