The Absorption Spectrum of Gaseous Silver Fluoride

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ALTHOUGH the properties of the excited electronic states of the silver halides are of considerable theoretical interest,[1] in the case of AgF only a brief account, giving the vibrational analysis of one system, B ← X, has so far been published.[2] We now give a preliminary account of a high resolution study of the absorption spectrum of gaseous AgF in the region 3100 to 3550 Å.

The spectrum was photographed on a 3·4 m Jarrell Ash spectrograph at temperatures of about 1200 to 1300°c provided by a carbon tube furnace. The strongest feature is a continuum centred at about 3030 Å. At longer wavelengths, bands of two systems are observed, (i) B–X, with red degraded bands, as reported by Joshi and Sharma,[2] (ii) A–X, predominantly violet degraded, although in the 1–0 band, $B' \simeq B''$. At $\lambda < 2600$ Å, red degraded bands of a third system C ← X appear.

TABLE

Constants for states of ^{107}AgF

State	T_{00}	$\Delta G_{\frac{1}{2}}$	$\omega_e\chi_e$	
B 0^+	31594·13	376·0	0·27	
A 0^+	29250·88	455·45	—	
$X^1\Sigma^+$	0	508·27	2·59	
	B_0	$10^3\alpha$	10^7D	r_0, Å
B	0·2555	—	4·7	2·022
A	$0{\cdot}2727_5$	$6{\cdot}_1$	3·66	1·958
X	0·2648	1·9	2·88	1·986

$\mu(^{107}AgF) = 16{\cdot}137$ a.m.u.
The values of $\Delta G_{\frac{1}{2}}$ and of $\omega_e\chi_e$ for B 0^+ are from reference 2.

The assignment of the first two systems to AgF is confirmed by study of the isotope effect between ^{107}AgF and ^{109}AgF.

The rotational analysis of the 1–0, 0–0, 0–1, 1–1 and 1–2 bands of A–X and the 0–1 and 0–2 bands of B–X has been completed. Both systems are of the type $0^+ - {}^1\Sigma^+$. All the upper levels show predissociations and in A, only $v = 0$ and 1 are observed: in B, $v = 0$ is the only level to show sharp rotational structure. The spectrum seems not to have been observed in emission and it is possible that all levels in A and B are predissociated, for $v = 0$ in A lies at 29251 cm.$^{-1}$ above $v = 0$ in $X^1\Sigma^+$, close to the dissociation limit given by thermochemical studies,[3] $D^0_{298} = 29660 \pm 1400$ cm.$^{-1}$. An attempt may be made to estimate a limiting curve of predissociation in A from the J values in $v = 0$ and 1 at which the lines become observably broad: this gives $D^0_0 < 29830$ cm.$^{-1}$, but the slope of this line indicates that this limit is that of a potential maximum at $r \sim 2{\cdot}4$ Å.

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