

## Emission Spectrum of the AsP Molecule

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A SYSTEM of red-degraded bands in the region 2960—3220 Å attributed to the new molecule AsP has been observed in a microwave discharge through a flowing mixture of AsCl<sub>3</sub> and PCl<sub>3</sub>. The spectrum has a simple vibrational structure and is very similar to that of the known AsN(*A*<sup>1</sup>Π—*X*<sup>1</sup>Σ) system.<sup>1</sup>

Pressures of approximately 15 microns each of PCl<sub>3</sub> and AsCl<sub>3</sub> (Baker and Adamson) were used. The microwave discharge was generated by a Burdick model M.W. 1200 microwave unit operating at 2450 MHz and rated at 125 watts. The emission spectrum was originally recorded on Ilford HP3 plate using a Hilger medium quartz spectrograph but has since been re-photographed using a 30 ft.

TABLE 1  
Band heads of AsP spectrum

| <i>v'</i> — <i>v''</i> | λ Å (in air) | $\nu$ cm. <sup>-1</sup><br>( <i>in vacuo</i> ) <sup>a</sup> | Intensity <sup>b</sup> |
|------------------------|--------------|---|------------------------|
| 3-0                    | 2961.57      | 33756.0   | 4                      |
| 4-1                    | 2974.7       | 33607   | 2                      |
| 2-0                    | 3002.77      | 33292.9   | 8                      |
| 3-1                    | 3015.3       | 33154   | 3                      |
| 1-0                    | 3045.50      | 32825.8   | 10                     |
| 2-1                    | 3057.7       | 32694   | 1                      |
| 0-0                    | 3089.83      | 32354.7   | 6                      |
| 1-1                    | 3102.17      | 32226.1   | 3                      |
| 2-2                    | 3114.4       | 32099   | 3                      |
| 0-1                    | 3148.22      | 31754.8   | 9                      |
| 0-2                    | 3208.43      | 31158.9   | 7                      |
| 1-3                    | 3220.96      | 31037.7   | 4                      |

<sup>a</sup> Six-figure wave numbers were obtained from high resolution plates. The other bands were observed in the Hilger spectrograph but because of overlapping could not be measured more accurately on high resolution plates.

<sup>b</sup> Relative intensities as found in Hilger spectrograph.

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<sup>1</sup> J. W. T. Spinks, *Z. Physik*, 1934, **88**, 511.

<sup>2</sup> C. H. D. Clark, *Trans. Faraday Soc.*, 1937, **33**, 1390.

concave grating spectrograph at the Institute of Physics, University of Stockholm.

Table 1 presents the band heads of the AsP spectrum. Estimates of relative intensities as found in the Hilger spectrograph are included. The heads of the weaker bands are difficult to measure because of overlapping As<sub>2</sub> and P<sub>2</sub> bands. From the observed band heads the vibrational constants of the two electronic states and the relative value of *T*<sub>e</sub> of the upper state were calculated and are summarized in Table 2. The value obtained for  $\omega_e$  of the lower state

TABLE 2

Constants for the two electronic states of AsP (cm.<sup>-1</sup>)

| State | <i>T</i> <sub>e</sub> | $\omega_e$ | $\omega_e X_e$ |
|-------|-----------------------|------------|----------------|
| Upper | 32419                 | 475.1      | 2.0            |
| Lower | 0                     | 603.9      | 2.1            |

is within 1% of the value of 598.5 cm.<sup>-1</sup> predicted by C. H. D. Clark<sup>2</sup> for the ground state of AsP. It is thus probable that this new transition involves the ground state of AsP. In addition preliminary rotational analysis strongly suggests that the bands are due to a <sup>1</sup>Π—<sup>1</sup>Σ transition, analogous to the bands of AsN. However, this must be confirmed by detailed rotational analysis.

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