neglected. The energy of the metallic lattice is then composed of the following parts:

1. Electrostatic energy \( \sim -1/d \) (taken from Wigner and Seitz\(^2\))
2. Exchange energy after Bloch\(^3\) \( \sim -1/d \)
3. Correlation energy after Wigner\(^4\) (from Fig. 7 of \(^4\))
4. Thomas-Fermi energy \( \sim 1/d^2 \)
5. Additional energy = El. density \( \times \int_0^1 \frac{e^{-2\pi d r}}{r^2} \frac{1}{d^2} \)

The Table I gives the values found in this way for the heat of sublimation and \( d_0^* \). Through improvement of the uniform distribution of the valence electron in the lattice, a further approach of the heat of sublimation to the experimental value may be attained. That the additional energy reproduces well the influence of the kernels upon the valence electron is demonstrated by the calculated \( \delta E/\delta V \) which agrees much better with the experimental data than the calculation of Rice\(^5\) who instead of our introduction of the additional energy assumed the kernels to be impenetrable and determined their radius empirically from \( d_0^* \) itself. The relationship between sublimation energy, ionization energy and the work function first established by Wigner and Bardeen\(^6\) is also valid in this theory.

### Table I

<table>
<thead>
<tr>
<th>Lattice Const. (A)</th>
<th>Binding Energy (eV)</th>
<th>Work Function (ev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>calc.</td>
<td>exp.</td>
<td>calc.</td>
</tr>
<tr>
<td>Na</td>
<td>4.35</td>
<td>4.42</td>
</tr>
<tr>
<td>K</td>
<td>5.20</td>
<td>5.28</td>
</tr>
<tr>
<td>Rb</td>
<td>5.75</td>
<td>5.62</td>
</tr>
<tr>
<td>Cs</td>
<td>6.15</td>
<td>6.05</td>
</tr>
</tbody>
</table>

Column 4 gives the work function calculated in this way, omitting the double layer term. When one bears in mind that the only empirical data used are the spectra of the free atoms the agreement is satisfactory and there is the hope that this simple approximation method will prove useful for further metallic problems where the more vigorous methods become involved in formal difficulties.

The complete work will appear in the *Acta Physicochimica U.R.S.S.*

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*Li was omitted, as in this case the application of a statistical method is not free of arbitrariness.


The Raman Spectra of Carbon and Silicon Tetrafluorides

We have photographed the Raman spectra for the tetrafluorides of carbon and silicon in both the liquid and gaseous states. The results are presented in Table I together with the Raman frequencies of CCl\(_4\) for purposes of comparison. The relative intensities are given in parentheses.

<table>
<thead>
<tr>
<th>CF(_4)</th>
<th>SiF(_4)</th>
<th>CCl(_4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \omega_1 ) (cm(^{-1}))</td>
<td>( \omega_2 ) (cm(^{-1}))</td>
<td>( \omega_3 ) (cm(^{-1}))</td>
</tr>
<tr>
<td>904 (10)</td>
<td>437 (1)</td>
<td>1200 (0)</td>
</tr>
<tr>
<td>800 (10)</td>
<td>285 (1)</td>
<td>1000 (0)</td>
</tr>
<tr>
<td>450</td>
<td>214</td>
<td>775</td>
</tr>
</tbody>
</table>

So far only \( \omega_1 \) for SiF\(_4\) has been found, the other three lines being apparently of small intensity. For gaseous CF\(_4\), only \( \omega_4 \) was definitely seen on the plates, and it was sharp and strong. \( \omega_2 \) and \( \omega_3 \) together with \( \omega_1 \) were obtained from CF\(_4\) at \(-120^\circ\).

The CF\(_4\) was prepared by treating carbon (Norit) with fluorine gas and submitting the raw product to a number of fractional distillations. It is difficult to prepare pure CF\(_4\). The SiF\(_4\) was prepared by a conventional method.

The assignment of frequencies is based on a number of considerations. Since \( \omega_1 \) is the completely symmetrical vibration, it should appear intense and sharp in the Raman spectrum. Accordingly the strongest and sharpest observed line was assigned to \( \omega_1 \). It was found, from a consideration of the Raman spectra for eight tetrahalides that certain regularities existed (approximate constancy of ratios of corresponding frequencies), and on the assumption that no discontinuities in these regularities would occur with CF\(_4\), the frequencies \( \omega_2 \) and \( \omega_4 \) were assigned.

The frequencies given in parentheses were computed from empirically found ratios, or from the formulae derived from normal coordinate treatments of tetrahedral molecules by Urey and Bradley,\(^1\) and Rosenthal.\(^2\)

Two absorption bands in the infrared spectrum of CF\(_4\) have been observed recently by Eucken and Bertram,\(^3\) namely, \( \omega_3 = 1350 \) cm\(^{-1}\) and \( \omega_4 = 653 \) cm\(^{-1}\). The latter is in fair agreement with 635 cm\(^{-1}\) found in the Raman spectrum, and the estimate (1200) for \( \omega_3 \) is, considering the theory involved, in accord with \( \omega_3 = 1350 \) cm\(^{-1}\). Eucken and Bertram estimate \( \omega_2 \) to be 503 cm\(^{-1}\) from specific heat measurements, and this agrees only moderately well with the observed value, \( \omega_2 = 437 \) cm\(^{-1}\). The disagreement is probably to be assigned to errors in the theory or measurement of the specific heats.

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