A Modification of Lees' Method for the Determination of the Heat Conductivity of a Poor Heat Conductor

Paul C. Oversheet
under these circumstances spreads laterally over the edge of the plate in a thin stream. Under the action of gravity and surface tension this thin bubble-like stream assumes various forms determined by the velocity of the stream impinging upon the plate and the dimensions of the various parts of the apparatus.

The bubble may be made to assume a more or less nearly spherical form or, by joining a free water surface below, to shape itself into the form of a bell. The smooth unbroken forms assumed by this film-stream are very striking, affording a beautiful illustration of surface tension effects and give promise of a convenient means of studying certain surface tension phenomena.

A MODIFICATION OF LEES' METHOD FOR THE DETERMINATION OF THE HEAT CONDUCTIVITY OF A POOR HEAT CONDUCTOR

PAUL C. OVERSHEET

Lees' Method is described at length in the Phil. Trons. A 1898, vol. 191, also in a general way in Poynting and Thompson's "Heat" and Watson's "Textbook of Physics." The modified method is described in detail in "The Measurement of the Heat Conductivity of Sulfur and a Sulfur-Coke Mixture," Physics Thesis by Paul C. Overstreet, State University of Iowa, 1925. This method consists of the measuring of the temperatures of a hot copper disk, \( U \), on one side of a poor heat conducting disk, \( S \), and that of a cooler disk, \( M \), on the other side of \( S \), after the system has come to a steady state—heat being furnished to \( U \) as described in Lees' Experiment. The exposed end and edges of the disks are coated with a substance whose emisivity for various temperatures has been separately determined. The heat radiated from \( M \) is then calculated. That radiated from the edge of \( S \) is then calculated on the assumption that for a thin disk the temperature drop will be a linear function of the distance from the hot disk, \( U \). Using the same assumption and a linear relation for the radiation, an equation is found in \( \lambda \), the fractional part of the thickness of \( S \) the heat will travel on the average before it is radiated.

\[
\lambda^2 - 3 \frac{h - \frac{4a}{b(U_u - U_m)}}{b(U_u - U_m)} \lambda^2 + 3 \frac{h_u U_u}{b(U_u - U_m)^2} \lambda - \frac{3}{h_m U_m + h_u U_u + h_u U_u - \frac{4a}{b(U_u - U_m)}} = 0
\]

\[k = h_m U_m t_s + \frac{1 + \frac{2t_m}{U_u - U_m}}{3r(U_u - U_m)}(h_m U_m + h_u U_u + h_u U_u - \frac{4a}{b(U_u U_m)})\]
### COMPARATIVE RESULTS

#### SULFUR

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Lees' Formula</th>
<th>Modified Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>22°C</td>
<td>5.96x10^-4</td>
<td>7.93x10^-4</td>
</tr>
<tr>
<td>40</td>
<td>6.33</td>
<td>6.35</td>
</tr>
<tr>
<td>53</td>
<td>5.91</td>
<td>5.97</td>
</tr>
</tbody>
</table>

#### SULFUR-COKE MIXTURE

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>10.79</td>
<td>11.89</td>
</tr>
<tr>
<td>64</td>
<td>18.76</td>
<td>18.45</td>
</tr>
</tbody>
</table>

The symbols involved are as follows:

- \( k \) = thermal conductivity.
- \( k_m, h_m \), emissivity at temp. of \( m \) or of \( u \).
- \( U_m, U_u \), temperature of \( m \) or \( U \).
- \( t_m, t_u \), thickness of \( m \) or of \( S \).
- \( r \), the radius of one of the disks — about 2 cm.

- \( a \) and \( b \) are constants involved in the emissivity equation,
  \[ h = a + bU. \]

Their value was determined by a separate experiment.

### THE PHOSPHORESCENCE OF FUSED QUARTZ

**A. C. Bailey**

Experiments performed here corroborate the report of Drummond and Webster that fused quartz can be activated to phosphorescence by being irradiated with ultra violet light from a quartz mercury vapor lamp. It is also found that the fused quartz is thermoluminescent. The radiations emitted from the phosphorescent and thermoluminescent quartz appear to be confined largely, if not completely, to the visible region. These radiations, however, at ordinary room temperatures, are of such low intensity as to be invisible to the eye.

If the fused quartz is raised to a temperature considerably above that of the room, the intensity of the radiations becomes sufficiently great as to make the glow distinctly visible. At ordinary room temperatures the phosphorescence is sufficiently strong to produce an image of the quartz on a photographic plate within one of two days exposure. If the quartz is thermally agitated to visible luminescence, the image may be obtained within a few seconds.

The phosphorescence appears to be confined chiefly to the edges particularly the broken edges of the quartz and to scattered spots. These scattered spots glow very brightly when the quartz is agitated to thermoluminescence. The glow persists for half an