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OVERTURNING AND ANCHORING OF MONOLAYERS*

By Dr. IRVING LANGMUIR

ASSOCIATE DIRECTOR OF THE RESEARCH LABORATORY, GENERAL ELECTRIC COMPANY

IN some studies of the mechanism of the flotation process made several years ago¹ monolayers of oleic acid were spread on water, and by a dipping process were deposited upon solid surfaces of glass, platinum, mica, calcite, sphalerite and galena. With each of these solids no monolayer was deposited on the down-trip into the water, but on the up-trip the surface came out of the water initially wet and on top of the water film there was a monolayer of oleic acid. After the draining out or evaporation of the water film the hydrophilic groups in the oriented oleic acid molecules were brought into contact with the solid surface to which they adhered more or less firmly, depending on the nature of the solid. Repeated dipping into a clean water surface, dusted lightly with talc, proved that for all the surfaces except mica little or none of the oleic acid monolayer escaped onto the water.

* Address of the vice-president and chairman of the Section of Chemistry, American Association for the Advancement of Science, Indianapolis, December 28, 1937.

¹ I. Langmuir, *Trans. Faraday Soc.*, 15: 62, 1920, reprinted in *G-E Rev.*, 24: 1025, 1921.

Two methods were used for detecting and studying the properties of these deposited monolayers: observations of the lubricating properties and of the contact angles given by drops of water placed on the surface.

The monolayers on the solid surfaces had an enormous effect upon the static friction of small glass sliders placed on the surface. On glass without the film the sliding angle was over 60°, but this was reduced to about 6° by the monolayer.

Drops of water placed upon a clean surface of any of these solids spread over the surface, wetting it completely, thus giving a zero contact angle, 0. The clean surfaces are therefore hydrophilic. After the oleic acid monolayers had been deposited, the surfaces became hydrophobic and the contact angles depended greatly upon the character of the underlying solid. With mica the angle was 18°, 45° for glass, 65° for platinum, 70° for calcite, 82° for sphalerite and 86° for galena.

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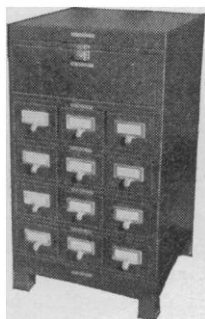
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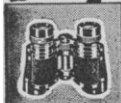
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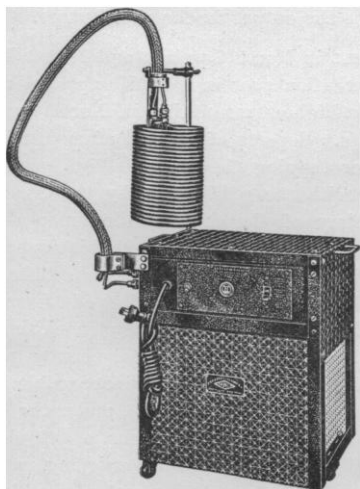
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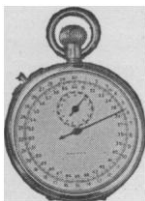
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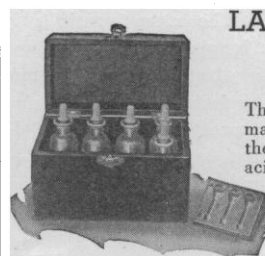
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