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EXPERIMENTAL INVESTIGATION OF CONTACT ANGLES OF RIVULETS FLOWING DOWN A VERTICAL SOLID SURFACE

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NOMENCLATURE

θ, contact angle;
X, rivulet width;
Q, volumetric flow rate.

THE PROBLEM of rupture of a thin film flowing down a vertical surface has been discussed by many authors. Ponter and Aswald [1] compared the values of minimum film thickness derived from theories and experiments. The authors attributed the scatter in the data obtained to the difficulties of rigorous determination of the contact angle values for gravitationally falling rivulets [3] which are much smaller than those determined using the droplet method. The present work is concerned with the effect of the surface roughness on the behavior of the contact angle. The contact angle between water and a copper surface was measured by a simple method developed by Langmuir [4]. The experimental results are presented graphically in Fig. 1, where the contact angle is given as a function of the rivulet width, X, volumetric flow rate, Q, and the copper surface conditions.

The volumetric flow rate varied from 0.2 to 60 cm^3/min, the rivulet width, from 1 to 6 mm, and the contact angle ranged from 10 to 50°. The copper surface was polished mechanically with a 150 grain emery paper ($h \cong 2\,\mu$m).

The investigations have demonstrated the existence of a minimum contact angle which is characteristic for a given kind of the surface independent of both the flow number and the rivulet width. The influence of surface defects on metal surface wetting was described in [5]. It has been also shown that there exists a definite rivulet width for the contact angle equal to that which is characteristic for the given kind of the surface.

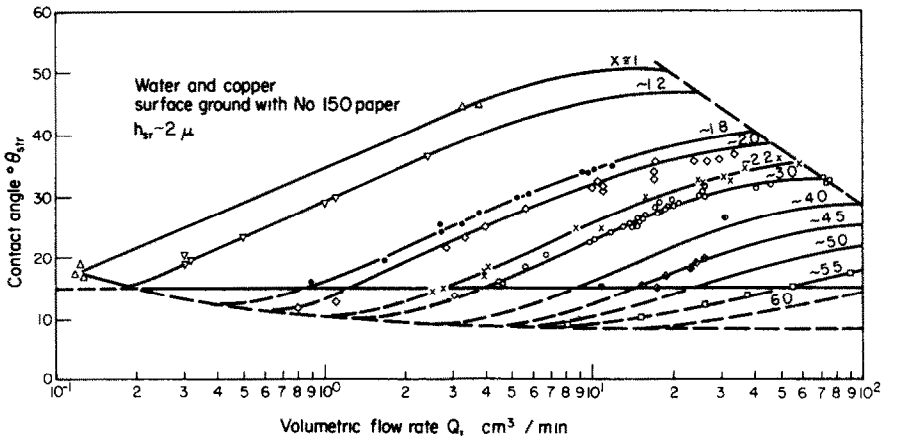

FIG. 1.

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