42. Measurement of the Coefficient of Friction by the Photo-elastic Method. (I)

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The coefficient of friction of a contact surface changes appreciably with the amount of lubricating oil, existing between the contact surface. Therefore, when we consider about the mechanism of the deformation of a body, we must measure the coefficient of friction of this deformed body, and if the photo-elastic method is used, this problem can be solved [1].

Now we compared the coefficient of friction determined by the direct method with that determined simultaneously by the photo-elastic method. For test piece of the photo-elasticity, we used 25 % parallelepiped gelatin-jelly [2] which was 24 mm. thick, and we measured the coefficient of friction between this jelly and an ebonite surface, supplying lubricating oil for the mechanical vacuum pump. The jelly was laid on an inclining plate, which was inclined gradually by a motor from a horizontal position and the angle of friction was determined directly by the angle between the horizontal surface and the inclinig plate, at the angle of which the ebonite on the jelly began to slide. Simultaneously the normal stress σ_y and the shearing stress τ_{xy} at the contact surface were measured by the photo-elastic method. And τ_{xy}/σ_y (the coefficient of friction) was determined. The next table is the result of the experiment.

	The angle of friction			The coefficient of friction		
Measured by the direct method	17.0°	7.5°	3.3°	0.31	0.13	0.058
Measured by the photo-ela. method	15.3°	7.7°	3.2°	0.27	0.13	0.056

As in the previous experiment, it is found in this case that angle between the principal stress at the contact surface and the normal of the contact surface is directly equal to the angle of friction.

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1) Uemura, Rep. Inst. Chem. Res., Kyoto Univ. Vol. 16 53. 1947
2) Uemura, ibid. Vol. 17 93. 1949
3) Uemura, ibid. Vol. 18 88. 1949