

FRICTIONAL PROPERTIES OF ELASTOMERS IN VACUUM UNDER HIGH NORMAL PRESSURES

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(Presented by Academician P. A. Rebinder, November 25, 1969)

Translated from Doklady Akademii Nauk SSSR, Vol. 191, No. 4, pp. 814-817, April, 1970

Original article submitted October 13, 1969

Studies of frictional behavior of elastomers under high normal pressure are now acquiring great importance due to the application of these materials in various sealing joints.

Ordinary friction apparatus does not permit the study of frictional properties of elastomers under high normal pressures due to the increase of the nominal area of contact. Lavrent'ev has developed an apparatus for studying friction in elastomers under high pressure [1] and has conducted studies of elastomers at up to 300 kgf/cm^2 [2]. The authors of the present paper have studied the friction of some filled rubbers in the atmosphere under pressures up to 10^3 kgf/cm^2 . To prevent misalignments, the apparatus [1] requires additional cumbersome equipment and its use for work in vacuum is difficult. An instrument which allows the study of frictional properties of polymers not only in atmospheric conditions, but also in vacuum, and which secures stability of the nominal area of contact under any pressures, was developed at the Research Laboratory of the Physics of Polymers at the V. I. Lenin Moscow State Pedagogical Institute. Like the apparatus of [1], the instrument is based on the use of hydrostatic pressure applied to elastomers satisfying approximately Pascal's law as for non-Newtonian fluids, which ensures the generation of controlled stress at the friction surface. A basic diagram of this instrument is presented in Fig. 1.

A thick-wall steel cylinder 1, with axial opening of 8 mm diameter and a hole 3 mm in diameter perpendicular to the axis, is installed in the vacuum chamber. A steel rod 2, ground to the cylinder's wall, is inserted in the hole.

Two specimens of the studied polymer 3, cylindrical in shape, 8 mm in diameter and 10 mm

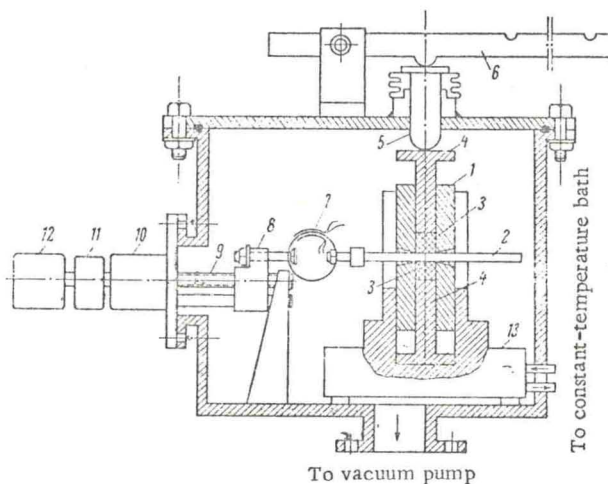


Fig. 1. A basic diagram of the instrument for studying in vacuum frictional properties of elastomers under high normal pressures.

high, are placed in the axial opening of cylinder 1 on both sides of the rod 2 to which they are pressed by steel pistons 4. Therefore, the measurement is of the friction between the elastomer specimens and the surface of rod 2. The specified compressing force is transmitted to pistons 4 from lever system 6 by push-rod 5 sealed with a metal bellows. Translational motion of rod 2 is produced with the required speed by the micrometric screw 9 which is revolved through magnetic clutch 10 by motor 12 with reducing gearbox 11. Between the nut of the micrometric screw 8 and the rod 2 a dynamometer ring is mounted with wire transducers whose signals are recorded by electronic automatic potentiometer ÉPP-09. The instrument is equipped with thermal unit 13 for producing temperatures from -100°C to 150°C . A vacuum of 10^{-4} to 10^{-6} mm Hg can be produced in the chamber.