The Measurement of Shear Dependent Viscosity of Simple Liquids

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The viscosity of simple, low-molecular-mass liquids is usually assumed to be independent of shear rate or shear stress. For certain types of tribological contacts, this assumption is no longer useful. These concentrated contacts are formed between the counterformal surfaces of machine elements made of high modulus materials. The films of liquid used to lubricate these contacts must flow under very high pressure, of the order of 1 GPa, in order to separate the surfaces. The shear stress applied to the liquid is of the order of 10 MPa. Analysis of the films requires that the viscosity under these conditions be known. A technique will be described for the measurement of viscosity at the pressure and shear stress of concentrated contact films. This technique has evolved in the author's laboratory over about thirty years. Major difficulties include passing mechanical and electrical information across the high pressure boundary and the removal of the heat of viscous dissipation.