

Viscosity for Highly Viscous Fluids at High Pressure

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Highly viscous fluids—such as honey, lubricants, and polymer melts—whose viscosity is more than a hundred times that of water, are widely encountered in both daily life and industrial processes. The viscosity of such fluids under high pressure is of great importance for practical applications. However, due to the limitations of sealing materials, existing commercial viscosity measuring instruments can only operate at pressures below 300 MPa, which fails to meet actual industrial demands. Consequently, there is a notable lack of viscosity data under conditions of both high pressure and high shear rate.

This presentation consists of three parts. The first part introduces the background, significance, and challenges associated with measuring viscosity under high pressure. The second part focuses on accurate viscosity measurement and modeling. We have developed an innovative method for measuring viscosity under high-pressure conditions, and have also derived a viscosity-pressure equation based on molecular parameters. The third part discusses the application of this model, specifically the implementation of smart lubrication in the wind power industry, supported by experimental data and the mechanistic insights provided by the Stribeck curve. It is anticipated that this work will contribute to three key areas: high-pressure viscosity measurement, the development of viscosity-pressure equations, and the advancement of smart wind power technologies.