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Through-Thickness Flow Profile Determination of Confined Lubricant[1] JANET WONG, ALEKS PONJAVIC, Imperial College London — The knowledge of the through-thickness flow profile of lubricants confined between two rubbing surfaces is necessary for the friction prediction of lubricated engineering systems. While it is crucial to materials selection and engineering design, little work on the direct measurement of lubricant flow has been performed in elastohydrodynamic lubrication (EHL) regime as the nanoscopic film thickness bars the use of conventional techniques. Photobleached-fluorescence imaging was applied to obtain the first experimental flow profile of a ∼100 nm lubricant film within an EHL contact. Mapping of flow profiles was also carried out across the contact. The investigated lubricants show multiple flow phenomena. They do not follow the predicted Couette flow, often assumed in tribology theory. Two distinct flow conditions were observed: transition from Couette flow to a non-linear velocity profile; and shear banding, or dilation. Both conditions were shown to depend on position and normal stress experienced by the lubricant. Causes, such as pressure gradient and limiting shear stress, and the effect on traction, will be discussed.

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