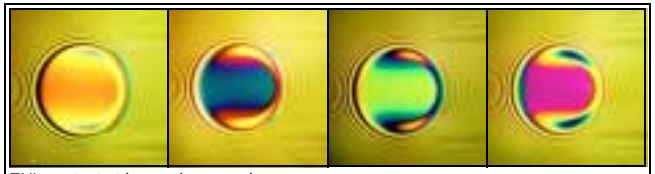
EHL Ultra Thin Film Measurement System

The EHL Ultra Thin Film Measurement System is a computer controlled instrument for measuring the film thickness and traction coefficient (friction coefficient) of lubricants in the elastohydrodynamic (EHL) lubricating regime. The instrument can measure lubricant film thickness down to 1 nm (1 millionth of a millimetre) with a precision of +/- 1 nm. Traction coefficient can be measured at any slide/roll ratio from pure rolling up to 100%. The instrument measures these lubricant properties in the contact formed between a steel ball and a rotating glass or steel disk. The contact pressures and shear rates in this contact are similar to those found in for example, gears, rolling element bearings and cams.

Applications of the instrument include:

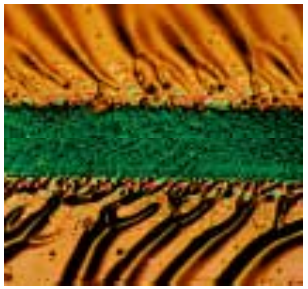
- Evaluation of film forming and frictional properties of oils and greases
- Starvation and reflow characteristics of grease lubricated components
- Fuel economy prediction of candidate crankcase oils
- Performance prediction of oil-in-water emulsion rolling mill lubricants
- Fundamental investigations of the high pressure/high shear behaviour of fluids such as liquid crystals
- Investigation of boundary additive performance

The instrument has been developed from research work carried by the Tribology Group at Imperial College, London. Some 20 systems are in use worldwide. It is the only commercially available system of its type.

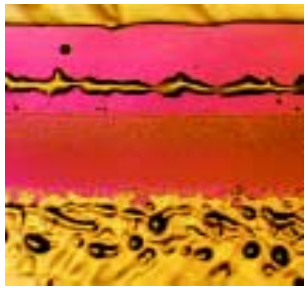


EHL contact at increasing speeds

The EHL System measures lubricant film thickness by optical interferometry. The sequence of pictures above shows an interferometric image of an EHL contact at increasing rolling speed and hence increasing film thickness. The lubricant film thickness at any point in the image can be accurately calculated by measuring the wavelength of light at that point. In practice the system measures the wavelength of the light returned from the central plateau of the contact and hence calculates the central film thickness.

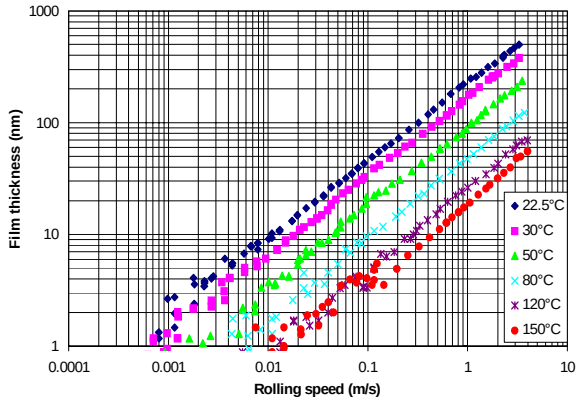


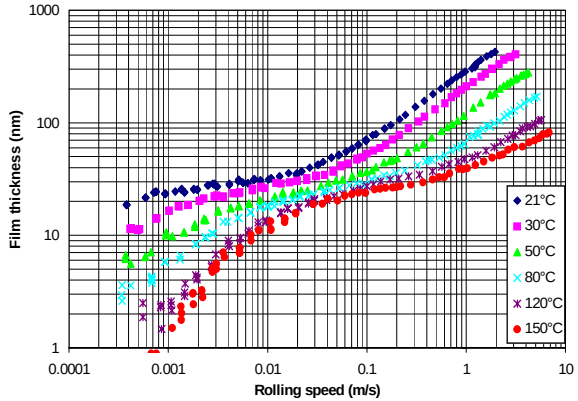
Residual Grease Track



Residual Grease Track

The images above show residual grease films deposited on the glass spacer layer disc of the EHL system. These images can be analysed to give information about the leakage process by which the rolling track is replenished with oil from the grease matrix. This work is part of an on-going programme of research using the EHL system in the Tribology Laboratory at Imperial College.





The two graphs above show central film thickness vs rolling speed at a range of lubricant temperatures. The upper graph is for an additive-free, 100 solvent neutral base oil. The lower graph shows the same base oil with the addition of 10% wt of a viscosity index improver (dispersant poly(ethylene propylene) copolymer). There is a marked increase in the film thickness in the 15-30 nm range.

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