

Raman microscopy applied to spectroscopic mappings in static and dynamic sphere plane contacts containing organic layers.

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Photonic microscopes are extensively used for morphologic studies in various fields of material science. The coupling of a photonic microscope with a visible spectrometer in the early eighties led to the development of Raman microprobes [1] which capabilities today allows us to acquire high energy (0.5cm⁻¹ resolution) and high spatial resolution (probe diameter less than 10 nm) spectroscopic images.

In this work, Raman micro spectrometry is applied to in situ pressure measurements [2 – 5] in both static and elasto-hydrodynamic lubricated (EHL) sphere/plane contacts. For this purpose, experimental set-ups coupling a Raman microprobe and static and elasto-hydrodynamic ball on disc tribometers have been developed. Pressure profiles and pressure maps have been recorded under static conditions, under low shearing using polystyrene as pressure probe and in pure rolling and rolling sliding conditions using 5P4E as lubricant and pressure probe.

Spectroscopic maps are acquired with optical probe diameter less than 10 micrometers. Pressure measurements being deduced from Raman band shifts, special attention is paid to Raman band intensities which can be related to the lubricant film thickness in static or low shearing conditions and to the molecular orientation induced by shearing effects in rolling or rolling/sliding contacts.

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- [1] P. Dhamelin court, "Developments and applications of the Laser Raman Microprobe MOLE", Proc. Of the 14th Microbeam Analysis Society Conf., San Francisco Press, (1979)
- [2] J.L. Mansot, "Etude des pressions dans un interface sphère/plan en présence d'une couche mince organique", PhD Thesis, University of Lyon, France , n° 86.50 (1986)
- [3] I. Jubault, J.L. Mansot, P. Vergne and D. Mazuyer, ASME Trans., J.of Tribology, vol.124, (2002) 114.
- [4] Jubault, J. Molimard, A.A. Lubrecht, J.L. Mansot and Ph. Vergne, Tribology lettres, vol. 15, n° 4, (2003) 421.