An evaluation of the friction response of laser produced textures incorporating ordered and stochastically distributed features

P.W. Butler-Smith [1], J. Radhakrishnan [1], R.N. Esfahani [1], G. Slater[1], J-H. Groth [2]

1- The Manufacturing Technology Centre, Pilot Way, Ansty Business Park, Coventry CV7 9JU, United Kingdom
2- Advanced Manufacturing Group, Faculty of Engineering, The University of Nottingham, University Park, Nottingham NG7 2RD, United Kingdom

Corresponding author: Paul.Butler-Smith@the-mtc.org

Direct Laser Writing (DLW) processes employing ultra-short-pulsed laser sources and optical elements incorporating galvo-scanners, allow an extensive variety of surface textures to be produced, by manipulation of the laser beam. While this setup allows near endless possibilities of texture feature geometries such as shape, size and spacing to be generated, surface textures are commonly produced having ordered arrays of identical features such as grooves, dimples or other regular polygons [1].

For tribological applications, ordered textures with designed orientations which are optimised for specific contact conditions, where for example, contact pressure, sliding velocity and sliding direction are known, often present an ideal arrangement for the enhancement of surface performance [2]. However, there are cases where such contact conditions cannot be reliably predicted, presenting difficulties in optimising ordered textures for the presented application.

To gain a better understanding of the performance of surface textures at different contact conditions, this study compares the friction response of laser generated ordered arrays of dimple and groove features at defined angles of sliding contact with those achieved by stochastically distributed dimple features [3] under conditions selected to achieve boundary, mixed and hydrodynamic lubrication, using chromium steel contact pairs.

It has been found that the orientation of regular texture features has a significant influence on sliding friction performance for the selected material pairs under specific lubrication regimes. However, the variation of sliding friction with orientation angle is notably reduced with the stochastically distributed texture features, indicating that such texture designs can find application where such conditions vary or cannot be easily predicted.

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