FRICTION RESPONSE OF LASER GENERATED STOCHASTICALLY DISTRIBUTED AND ORDERED TEXTUES FOR RIGID AND COMPLIANT COUNTERPART CONTACT

P.W. Butler-Smith [a*], J. Radhakrishnan [a], R.N. Esfahani [a],
*Paul.Butler-Smith@the-mtc.org
[a] The Manufacturing Technology Centre,
Pilot Way, Ansty Business Park, Coventry CV7 9JU, United Kingdom

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ABSTRACT

Laser processing offers the potential of enhancing the performance of surfaces for a wide range of applications, through surface texturing. Direct Laser Writing (DLW) processes, employing ultra-short-pulsed laser sources and incorporating galvo-scanner arrangements in the laser's optical elements, allow an extensive variety of textures to be produced by the variations of features which make up the texture geometries, such as shape, size, protrusion, spacing and orientation.

In the case of surfaces for sliding contact, textures are commonly designed incorporating arrays of regular features such as dimples (Figure 1a) or grooves which are optimised for specific contact conditions where, for example, contact pressure, sliding velocity and sliding direction can be predicted [1, 2]. However, cases exist where these contact conditions cannot be readily predicted. For such applications, textures having stochastically distributed features (Figure 1b) can been produced using DLW processes.

This study compares the friction response of ordered arrays of dimple and groove features at defined angles of sliding contact with those applied to stochastically distributed features under contact conditions selected to achieve boundary, mixed and hydrodynamic lubrication, using steel and aluminium contact pairs. In addition, a comparison is made of the friction response of a complaint polyurethane counterpart against textured steel surfaces for defined sliding angles under dry sliding contact.

It has been found that the orientation of regular texture features has a significant influence on sliding friction performance for both the rigid and rigid-compliant material pairs under the lubricated and dry conditions respectively. However, the variation of sliding friction with orientation angle is significantly reduced with the stochastic distributed textures, indicating that such texture designs can find application where sliding direction cannot be easily predicted.

a)

b)

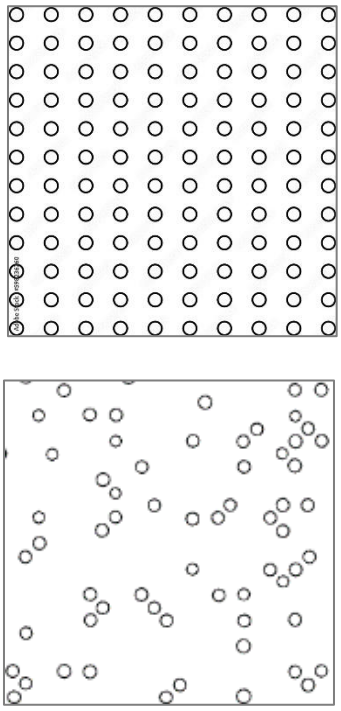

Fig.1a) Regular dimple texture and b) stochastically distributed dimple texture

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