Quantifying touch-feel perception on some treated thermoplastic materials

Thermoplastic elastomer (TPE) and copolymer of elastomer are commonly used in manufacturing car interiors to give the surface a less harsh and more pleasing feel. Designers and material scientists are finding ways to improve the perceived touch-feel attributes of the material and hence the appeal of the product. Identifying links between perceived psychophysical descriptors such as ‘rough/smooth’ of material surfaces to their physical parameters such as surface topography, surface mechanical and tribological properties is still an active research area. In this paper, a series of 5 patterned and 4 coated TPE surfaces provided by an automotive manufacturer were characterized—topographical parameters of the samples by a surface profiler and mechanical/tribological parameters by a Nano-indentation instrument.

The friction characteristics of these specimens were measured by using a newly developed friction test apparatus comprised of a multi-layered artificial finger mimicking human fingertip, a linear flexure mechanism and a reciprocal linear stage. The apparatus is capable of measuring the contact force and friction force simultaneously under different contact forces and stroking speeds. The results showed the artificial fingertip can represent the human fingertip friction.

Finally, 10 women and 11 men with different ages were asked to rank the specimens under 5 pairs of psychophysical descriptors. For ‘Like/Dislike’, the results showed most of men prefer the soft polymer samples which are comparably rougher while most of women prefer the coated smooth samples. In addition, higher friction seems to be preferred. Then Spearman’s rank correlation analysis between the touch-feel perception, friction measurements, and characterised specimen parameters were performed. The ‘smooth/rough’ ranking had statistically significant correlation ($p < 0.05$) with friction coefficient $\mu$ and topographical parameter $S_z$. Some of the results are shown in figures below.