Performance of injection-moulded carbon nano-tube polypropylene asymmetric gears

Performance of injection-moulded polypropylene (PP) gear was evaluated with and without air cooling, using in-house developed power absorption gear test rig. Measurement of gear weight, surface temperature and periodical measurement of tooth thickness confirmed the enhancement of wear resistance and gear life by the air cooling.

The effect of mating gear manufacturing process, wire-cut electric discharge machining (WEDM) and conventional hobbing over the performance of injection-moulded polypropylene gears was investigated. Test gear exhibited improved wear resistance when paired with conventional hobbed steel gear compared to the WEDM steel gear. The effect of mating gear surface roughness over the performance of injection-moulded asymmetric polypropylene gears were evaluated by pairing with three asymmetric steel gears having different surface roughness. Test gears paired with steel gear having higher surface roughness exhibited higher net surface temperature and inferior wear resistance. Durability of the injection-moulded symmetric (20/20) and asymmetric (34/20) gears were evaluated to understand the effect of drive side pressure angle. The increased radial distance of highest point of single tooth contact point and decreased contact ratio contributed to the poor performance of asymmetric gears.

The mechanical, tribological, and thermal behaviour of various (1–5 wt%) carbon nano-tube reinforced polypropylene was evaluated. Hardness and wear resistance has increased upto 1 wt% CNT-PP and decreased beyond 1 wt% due to the agglomeration. 1 wt% CNT–PP composite gear was injection-moulded and its performance was compared with unreinforced polypropylene gear. 1 wt% CNT–PP gears exhibited lower surface temperature and slightly higher transmission efficiency. Carbon nano-tube reinforcement has improved the test gear wear resistance and fatigue life.