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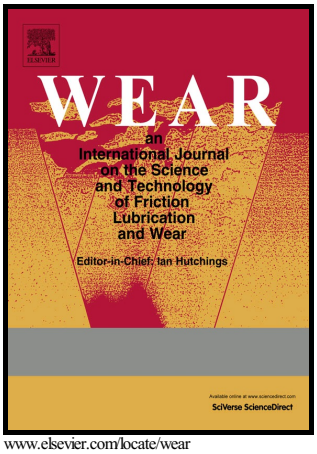

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On simultaneous improvement of wear characteristics, surface finish and microgeometry of straight bevel gears by abrasive flow finishing process

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Abstract

Improvement in operating performance, service life and transmission efficiency and reducing the noise of straight bevel gears (SBG) requires their better wear resistance, surface finish and microgeometry. Viscosity of the medium used in abrasive flow finishing (AFF) process and finishing time play very important role in achieving these objectives. This paper reports on simultaneous improvement of wear characteristics, surface finish and microgeometry of SBG by abrasive flow finishing (AFF) process by studying the effects of viscosity of AFF medium and finishing time so as to identify their optimum values through twenty experiments. Average and maximum surface roughness were used to study improvement in surface finish while, microgeometry was evaluated in parameters of pitch deviation and runout. Friction force, coefficient of friction, specific wear rate coefficient, wear volume, microhardness and microstructure of the worn surfaces were used to study the wear characteristics and wear mechanism of the best finished SBG. Use of AFF has significantly improved the wear characteristics, surface finish and microgeometry and quality of SBG. Reduced wear characteristics will reduce the frictional heating which will result in lower operating temperature of the bevel gears. Lower wear volume will improve their service life and mechanical efficiency. Microstructure study of the AFF best finished bevel gear flank surfaces revealed that they are free from hobbing cutter marks, cracks, burrs, pits, surface roughness peaks, thermal distortion. The worn flank surface of the best finished bevel gear have shown very less amounts of worn debris, pits and displacement of material and indicate scuffing mode of wear. This work helps in establishing AFF as an economical, sustainable and productive alternative process for finishing the gears made of any material which can simultaneously improve surface finish, wear characteristics, microgeometry and quality of the bevel gears.

Keywords: AFF; Wear characteristics; Surface roughness; Microgeometry; Bevel gear; Pitch; Runout; Viscosity.