Wear Models for plastic injection moulds failures

Borja Zabala, Amaya Igartua* and Raquel Bayon

Fundación TEKNIKER, C/ Ignacio Goenaga, 5, 20600 Eibar, Spain, borja.zabala.tekniker.es; amaya.igartua@tekniker.es; raquel.bayon@tekniker.es; www.tekniker.es

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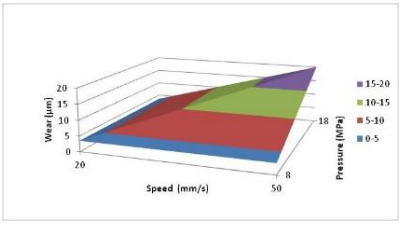
ABSTRACT

Injection moulding is a single-step manufacturing process for plastic parts that require very precise dimensions, geometries and low part roughness (Ra 0.2 ~ 0.025 μm). The high cost of moulds (typ. > 100,000 €) and unacceptable wear of their cavities can limit the cost competitiveness of the process. Mould cavity surfaces are deteriorated by different wear mechanisms which may drastically reduce the quality of injection moulded parts, interrupt their production, raise maintenance and repair costs, or delay delivery. Therefore, a better understanding of the wear mechanisms and the main parameters affecting mould wear is needed. In this paper, two major failure mechanisms were studied: abrasion and erosion (due to fibre-reinforcements in the plastics). Different surface treatments (physical vapour deposition, nitriding and electrolytic) were tested to increase reference moulds lifetime. Testing protocols were developed for each failure mechanism. Abrasion was simulated with a block-on-plate tribological test, erosion was evaluated in an air-jet erosion tester combined with a gravel-o-meter test. Several thermoplastic materials were tested. Useful recommendations for potential solutions for each failure mechanism were proposed.



Output	Cycles to failure
Abrasion	73659
Erosion	16671

a) b) c)

Figure 1. a) Surface response of abrasive wear tests dependence on pressure and speed. b) Surface response of erosion wear depending on impact angle (X2) and impact speed (X3). c) Prediction of cycles to failure

From the results obtained in the abrasion and erosion tests, a model was built to quantify the wear on PIM. The inputs needed in this model are the surface hardness of the mould material, the flow speed, and the pressure, to calculate the cycles to failure.

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