

Hardness loss of plastic mold steels: Phenomenon in injection molding

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Wear and in particular abrasive wear in injection molding is a core research topic for the institute of injection molding of polymers at Montanuniversität Leoben. The standard application-oriented test for abrasive wear of polymers on plastic mold steels is the platelet-wear-tester method in which two steel specimens form a thin wear slit. The glass fiber reinforced polymer melt is injected through the wear slit and the surface of both specimens is abraded. In the injection molding process similar conditions often occur in thin-walled parts or in film gates. A drastic loss of hardness of a powder metallurgical steel (PM-steel) was discovered after approx. 200 injection cycles while performing platelet-wear-tests.

For experimentally analyzing the reason for the loss of the steel hardness during injection molding a new platelet-wear-testing apparatus was developed which can be used to measure the increase of the temperature inside the steel specimen while testing. In systematic experiments the comparability of results generated with the new wear testing apparatus to those of the former platelet-tester were confirmed and the phenomenon of hardness loss was investigated in detail.

First results show and support the hypothesis that a temperature increase above the annealing temperature occurred inside the steel due to viscous dissipation at the steel surface. In cooperation with the company voestalpine BÖHLER Edelstahl & Co KG, tests on the PM-steel in a dilatometer were performed to simulate the cycle-by-cycle heat pulses occurring in the injection molding process. With the results of those tests it was possible to state a hypothesis for the reason of this hardness loss.

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