Investigation of Surface Distress in Injector Cams Under Conditions of High Friction

By
Iqbal Shareef
Professor
Mazin Mirghani
Research Assistant
Audhut Karmali
Research Assistant

Bradley University
Peoria, Illinois 61625

Abstract
Surface distress involving pitting, scuffing, frosting, and high friction leads to failure in fuel injector cams. The relationship amongst relative features of these failures are extremely complex. They comprise local plastic straining, cyclic softening/hardening, crack initiation/propagation, impact, skidding, and third body formation. From an industrial application point of view, determination of failure probability and service life expectancy are important. Although factors such as surface roughness, lubrication conditions, and third body particles are known to affect the life of gears and bearings, the effect of these factors on the life of cam-follower contact is little known. In particular, failure of cams due to pitting with friction is unclear. The objective of this research project supported by industry and NSF is to shed some light on the premature failure of fuel injector cams in IC-Engines. Towards this goal, an instrumented cam-follower test rig facility is designed and fabricated, followed by experimentation to reproduce filed failures in a laboratory environment under accelerated test conditions. The test scheme consists of running in the cam with three roller followers for 8 hours at an initial contact stress of 960 MPa, which is followed by running of the tests at 3500 MPa and 3800 MPa until camshaft failure occurs. Cam surface distress observed from this test is basically pitting on the base circle with severe backside sliding/scoring/galling. It is noteworthy to mention that it is the first time this backside sliding phenomenon on cam has been replicated in a laboratory environment.