A Novel Impact-Sliding Wear Tribometer for Truck Coupling Systems

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A truck coupling system consists of a bolt and clevis mounted on the truck and a drawbar with a wear ring on the trailer. Force is transferred from the trailer to the bolt via a drawbar eye where the wear ring is located. The contact surfaces between the bolt and the wear ring are worn by both sliding and impact at high loads. The environment is that which exists at the rear of a truck, i.e. presence of water, salt, and abrasive particles. The high loads and a motion that disengage the contacting surfaces combined with an abrasive-corrosive environment makes this tribological system difficult to simulate in a standard tribometer. The aim of this work is to develop a special purpose tribometer capable of simulating operating conditions prevalent in truck coupling systems.

The test rig is based on a vertically mounted coupling bolt which is fixed in a stationary specimen holder. The counter specimen is a small segment cut from the wear ring that is mounted on a spring loaded piston assembly. The piston assembly is mounted on four crankshafts that are rotated by a servomotor and belt-pulley system. During operation, the four crankshafts and the spring-loaded piston will generate a vertical and horizontal motion, which results in an impact-sliding contact between the wear ring and bolt specimens. The motion also completely separates the test specimens in each cycle, allowing any abrasive particles used during testing to enter into the contact. The test rig is capable of operating at high normal loads (10 kN) in presence of water/sand/corrosive media. A linear variable differential transformer (LVDT) continuously monitors the combined wear of the ring and bolt specimens. A LabVIEW-based software is used for control and data acquisition. Tests with standard bolt and wear ring specimens have been carried out at 3 kN and 6 kN normal load for two different durations of 1 and 3 hours. A water-based slurry with abrasive particles (1 liter H_2O and 55 grams of particles) was used. The particles were Powder Technology Inc A1 Ultrafine Test Dust ISO 12103-1.

The test results have shown that the wear mechanisms are similar to those seen in real bolt and wear ring components. The wear measurements through weight loss are repeatable and the effect of load and duration on wear can be assessed. A higher load resulted in less scatter of the wear measurements. A longer test duration is beneficial for stable online wear measurements using the LVDT sensor.

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