C29 The Characterization of the Slip-Test PIAST Tribometer by Characteristic Functions Based Upon Logistic Regression

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After attending this presentation, attendees will become familiar with newly developed methodologies to characterize tribometers using a "zero friction" test stand. Although the methodology can be utilized with any binary-output tribometer, the authors have utilized a specially modified Slip-Test PIAST. Logistic Regression is used to mathematically describe probability of a slip as a function of the indicated Available Friction.

This presentation will impact the forensic community and/or humanity by discussing research that indicates that the tribometric instrument tested (the PIAST) was not, at low friction readings (friction levels where pedestrian slips are expected to occur), a significant source of measurement uncertainty.

Flooring and shoe manufacturers, insurance companies, researchers, and forensic engineers sometimes disagree as to the import of in situ tribometer test procedures and results. The present paper describes a test methodology used to isolate the design parameters that can affect tribometric test results in a low friction environment. A low friction test stand was designed and built to reduce the effects of friction on the tribometer test results. Air bearings (manufactured by New Way Air Bearings, Aston, PA) were used in this test stand to allow a horizontal slider (containing these air bearings and sliding on machined horizontal rods) to move with essentially no friction. The tribometer 'foot' was covered with a material that resulted in no slippage between this foot and the mating surface of this horizontal slider. This combination (tribometer test foot in contact with horizontal slider surface) would slide with minimal frictional resistance along these machined rods. The tribometer 'mast angle measuring system' was modified to allow for finer adjustment of the mast of the tribometer, thereby allowing smaller angular increments to be used during these tests. A digital inclinometer was attached to this modified tribometer, allowing for angular measurements to the tenth of a degree. A horizontal force (calibrated weights) was applied to the tribometer mast to prevent the sliding (equivalent to a the in-plane (tangential) force during in situ testing) of the tribometer foot/slider combination. Specific weights were used, resulting in known horizontal forces applied to the mast of the tribometer. The angle of the tribometer mast was set such that the horizontal component of the tribometer's applied force at contact was equal to this applied horizontal force. Under these conditions, the tribometer should not slip. Using this same weight, the mast of the tribometer was varied slightly (in either direction-closer to and further away from the vertical) and large numbers test runs were conducted to determine 'probability function of the tribometer's slipping or not slipping. Logistic Regression was used to characterize these test results.

The results show that, at low friction values (where slips occur), the tribometer is not the source of the bulk of the uncertainty in the measurement of the in situ friction.

Forensic Science, Characteristic Function, Tribometry

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