Ebatco Nano
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Nano Brief

With a growing customer base and increasing lab service demand, addition of new talents is warranted for Ebatco's successful operations. To support its strategic business plan, rapid business growth, and increasing customer needs, Ebatco is seeking two experienced and highly motivated Technical Sales Engineers. One Technical Sales Engineer will have a residence in the Bay Area for sales in the Western US territory, and the other will have a residence in the Baltimore, Philadelphia, or DC Area for sales in the Eastern US territory.

Please contact us if you are interested in one of these positions!

Ebatco

We are happy to announce that our company president, Dr. Dehua Yang, has been named a 2022 Technical Editor for Tribology and Lubrication Technology (TLT) magazine!

Based on his extensive knowledge, years of experience, and reputation within the lubricants industry, Dr. Yang was chosen from many highly qualified individuals to determine TLT's editorial agenda and add to the lubrication industry's body of knowledge. TLT is the official monthly publication of the Society of Tribologists and Lubrication Engineers (STLE) and was created to aid in the technical education and professional development of STLE members and industry colleagues. Through its print and digital editions, TLT delivers world-class technical content to some 15,000 lubricant professionals every month. Each issue includes feature articles, best analytical practices, interviews with leading lubrication professionals, emerging-technology reports, and much more.

Case Study

Fracture and Plastic Resistances of Automotive Coatings Determined per ASTM D7187

Today's automotive clear and paint coatings are engineered to possess a wide variety of characteristics, such as attractive color quality, a high gloss shine, and resistance to weather and abrasion. To have all of these traits, clear and paint coatings have had to continuously adapt their formulations and processing in order to meet ever evolving performance, environmental and regulatory standards. ASTM D7187 is an international standard specifying how to evaluate a coating's scratch/mar resistance by measuring its fracture and plastic resistances. Fracture resistance is a measure of how much force must be applied to cause the coating to fracture or crack during a scratch test. This quantity is represented by a critical load value at an initial fracture. Plastic resistance is a measure of how much force is needed to plastically deform a unit depth of coating prior to coating fracture. This value is calculated through dividing the force by the residual scratch depth at a selected point along the scratch path before coating fracture. When different coatings are evaluated using the same testing conditions (scratch speed, loading rate, temperature, humidity, etc.), direct comparisons of each coating's fracture and plastic resistance can be used to rank the coatings' scratch and mar resistances.

In this study, exterior painted panels from two domestic and two foreign consumer vehicle brands were scratch tested. To comply with the ASTM D7187 standard, a Nano-Scratch Tester made by Anton-Paar in Switzerland was employed for these nanoscratch tests under the following testing conditions: conical-spherical diamond indenter tip with a tip radius of 2 μm, scratch speed of 3 mm/min, loading rate of 40 mN/min, and scanning preload of 0.5 mN. Prior to the nanoscratch tests, all samples were conditioned at the required temperature and humidity for at least 24 hours.

A typical set of scratch test data curves and its corresponding optical image of the coating at the point of fracture is shown in Figure 1.

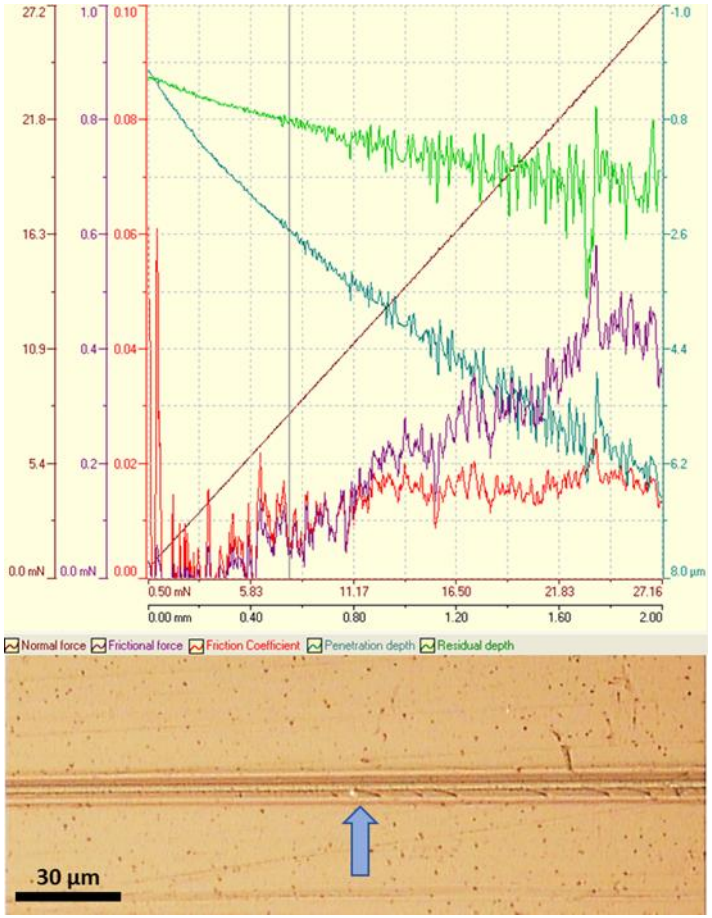

Figure 1. Scratch test data (top) and an optical image of coating fracture (bottom) on Domestic 2. The blue arrow indicates the fracture initiation point.

During the nanoscratch tests, the scratch tip dug into the coating gradually leaving a visible trench behind until a certain point when cracks would begin to form. These cracks started out small, but would become larger and larger along the scratch path. Figure 2 presents the average determined fracture and plastic resistance values along with the measurement error bars from three repetitive

measurements made on each paint coating panel. It can be seen from Figure 2 that the average fracture resistance values ranged from 4.63 to 7.82 mN, and the average plastic resistance values at 4 mN load ranged from 5.56 to 8.33 mN/µm. One coating, Foreign 2, had a significantly lower fracture resistance than the rest. Optical observation of Foreign 2 suggested that the low fracture resistance may be caused by poor adhesion between the coating and the substrate. Foreign 1 had lower plastic resistance values than the rest, indicating that this coating deforms plastically the most under the selected loading conditions.

One aspect to note for this study is the age of these coatings. These coating specimens were taken from used vehicles with aging and weathering histories. Exposure to environment, UV and road conditions may have caused the coatings to act differently from when they were freshly applied. Nevertheless, this study has provided insights on the coating performance after aging and exposure and would be useful for coating lifetime prediction and failure analysis.

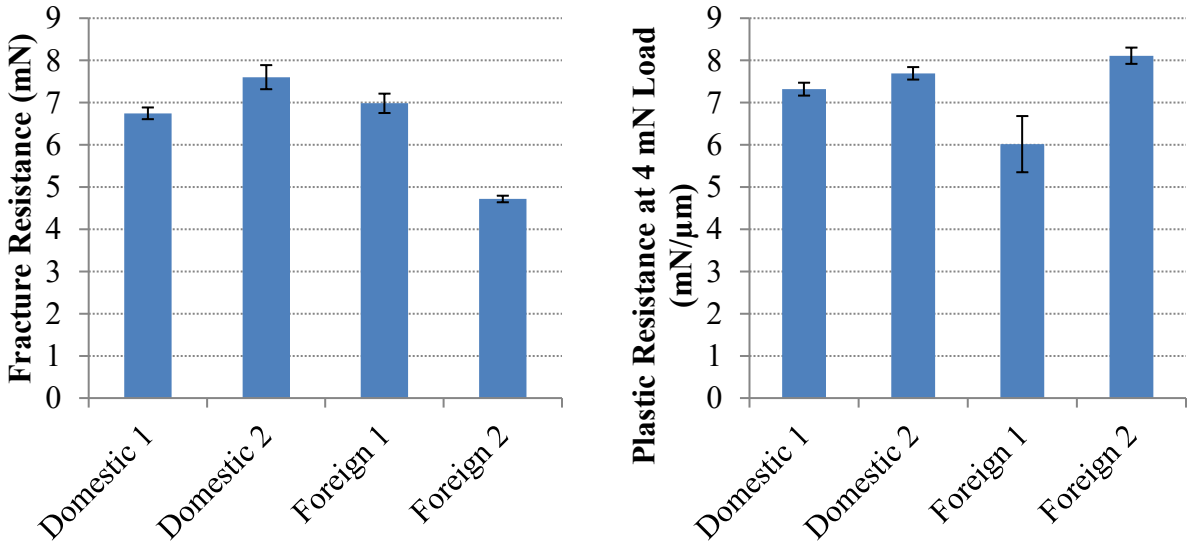

Figure 2. Average facture resistance (left) and plastic resistance (right) for all tested vehicle panel specimens.

As this study has demonstrated, scratch testing following ASTM D7187 standard offers a reliable testing approach to determine automotive paint coatings' fracture resistance and plastic resistance. This type of testing may be used in scratch and mar resistance determination, quality control, comparing different formulations, evaluating resistance to the environment, and predicting long-term performance of automotive coatings.

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