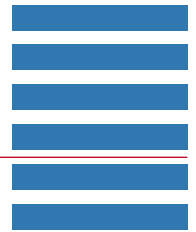


Scratch and Wear Testing

with the NanoTest Scanning Module



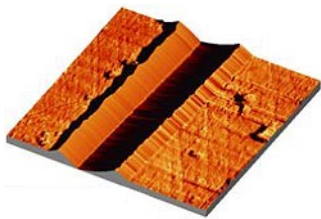
Key Features

- wear testing with multi-pass scratch technique
- scheduling software for maximum productivity - programming multiple scratches on multiple samples
- accurate repositioning technique
- film thickness and surface roughness
- friction and topography
- thin film adhesion failure

Applications

- scratch testing can be used to determine the strength of adhesion of a thin film to a substrate
- testing coating quality and homogeneity with constant-load scratching at different locations

Scratch Testing



scratch on hard disk read-write head

In the NanoTest Scanning Module, the sample surface is moved perpendicular to the diamond probe axis allowing the abrasive wear resistance of a coating to be investigated by either single or repetitive scratch tests.

Accurate repositioning combined with optional software enables complex multi-pass scratch tests to be scheduled (with much greater precision than a conventional scratch tester).

The NanoTest pendulum design is superior for scratch testing since deformation of the pivot is negligible, even with very high forces, giving accurate probe displacement results.

For example, sequential constant load scratches over the same wear track, with a low load topography measurement performed between each scratch, allow acquisition of elastic and plastic depth and friction data and the subsequent investigation of friction and adhesion failure mechanisms.

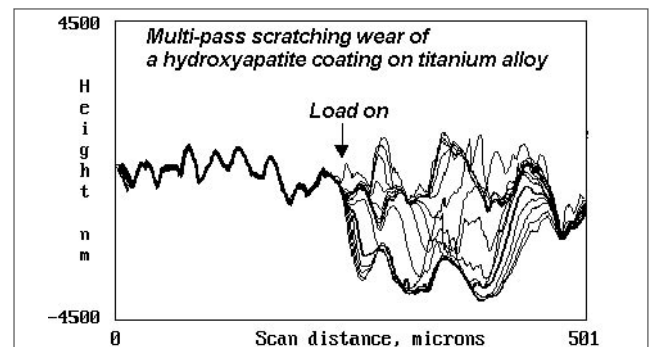
Data is acquired, analysed, displayed in real time, and stored under the control of a comprehensive software package. Six parameters can be recorded (load, depth, transverse displacement, frictional force,

acoustic emission and time), to provide a wealth of information about the surface. Analysis is simplified with comprehensive, fully automatic software; all that is required of the operator is to specify the type of analysis required. For flexibility, data is saved in ASCII format for spreadsheet and graphics export

"...Wear processes can be investigated with the multi-pass scratch technique..."

With the NanoTest, the abrasive wear performance of a coating can be investigated by means of a multi-pass scratch test. This procedure consists of sequential constant load scratches over the same track, with a low load topography measurement performed between each scratch. In this way, changes in depth and friction can be monitored simultaneously.

...clearly, the success of such a procedure depends on the ability to precisely and automatically relocate the stylus at the same starting point prior to each step...



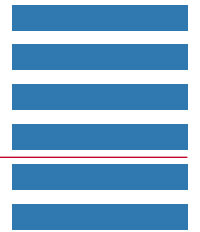
Measuring Coating-Substrate Adhesion Strength by Scratch Testing

The diamond probe is scanned across the surface under either a constant load or a progressively increasing load until film failure occurs. Scratching at different locations at constant load can be used to investigate coating quality and homogeneity.

By ramping the load it is possible to define a critical load (Lc) for adhesive failure of the coating-substrate system. Film failure can be detected by several methods using the NanoTest scanning module, e.g., (1) by the detection of an abrupt change in the displacement of the probe; (2) by a sudden change in the frictional force between the diamond and the surface; (3) by microscopic observation of the wear track; or (4) by detection of a burst of released acoustic energy.

Scratch and Wear Testing

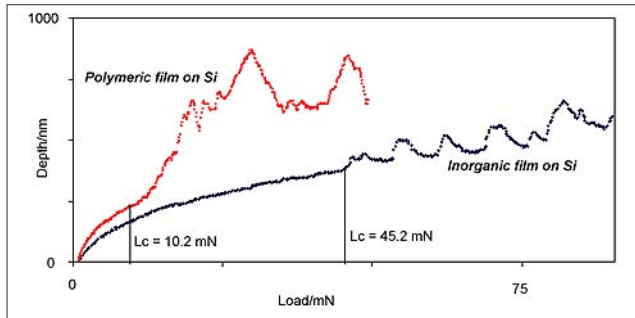
with the NanoTest Scanning Module



In the example shown below, scratch testing with the NanoTest Scanning Module reveals clear quantitative differences in wear-resistance between thin polymeric and inorganic coatings on the same substrate.



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Coating-substrate adhesion testing by ramped-load scratching wear