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White paper

Wear comparison testing between Renishaw OPTiMUM™ diamond styli and the standard ruby equivalent

OPTiMUM™ diamond styli range for extreme measurement applications

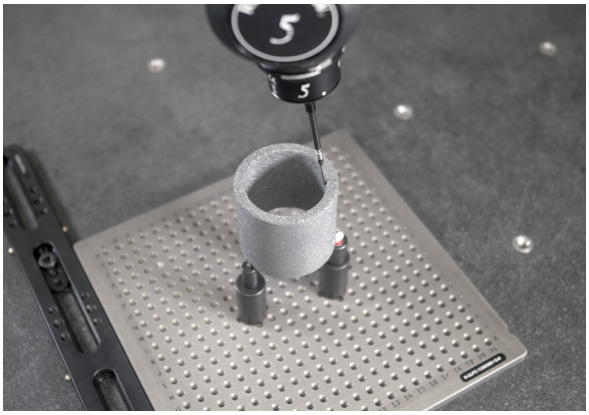
OPTiMUM diamond styli offer long-lasting scanning performance in demanding applications. The range has been specifically developed for use within metrology applications that require a hard-wearing stylus. The principal advantage of its chemical vapour deposition (CVD) diamond-coated spheres is that they will maintain their roundness and will not suffer from material 'pick up' or premature wear when scanning abrasive materials or soft aluminium alloys. Diamond-coated styli provide multiple benefits including increased working life and a reduction in recalibration and inspection downtime.

A test was conducted to determine the wear resistance of OPTiMUM diamond styli by demonstrating the ability of the CVD diamond-coated spheres to withstand wear through measurement on very hard materials. The OPTiMUM diamond styli were compared to the industry-standard ruby styli to demonstrate the difference in wear under extreme scanning conditions.

Silicon carbide was chosen as the test material to be scanned because it has very similar properties to diamond and is one of the hardest, strongest ceramic materials available. The test piece had an extremely rough surface finish of 16 Ra, making it highly abrasive.

Silicon carbide test piece with a surface finish of 16 Ra

The comparison test was conducted under strictly controlled conditions in a Grade 1 laboratory using a CMM fitted with a Renishaw REVO® 5-axis measurement system. Two calibrated ring gauges were used as a reference to detect any wear on the styli.



Test conditions in a Grade 1 laboratory using a CMM fitted with a Renishaw REVO® 5-axis measurement system

A test program was created that, in conjunction with the 5-axis head, ensured a single point of contact against the stylus ball during its scanning operation around the inside diameter of the test piece.

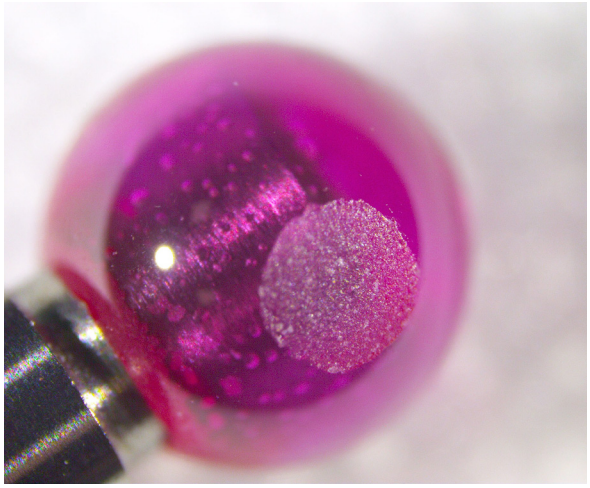
Test method

The silicon carbide test piece was fixed in position using a 6-point location modular fixture. Each stylus was calibrated and then put through a series of 25 m scans at a speed of 25 mm/s followed by two calibration checks to measure for potential wear. The same specification of stylus was used (3 mm diameter ball, tungsten carbide stem and stainless steel holder); the only difference being whether a ruby sphere or CVD diamond-coated sphere was used.

Renishaw OPTiMUM™ diamond styli range

Results

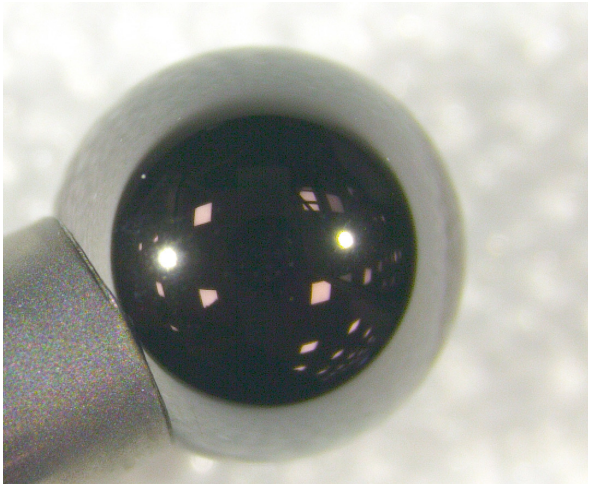
The standard ruby stylus first started to exhibit wear at approximately 3,500 m and the test was stopped at approximately 4,000 m due to the severity of wear. The depth of wear on the ruby ball resulted in a 2.5 mm diameter error when remeasuring the calibrated ring gauges.



Standard ruby stylus wear after 4,000 m

The OPTiMUM stylus was tested for approximately 10,000 m with no deterioration in ring gauge calibration performance and no visible marking or wear, as illustrated in the wear comparison test results below.

These results show that even under the most extreme scanning conditions, the OPTiMUM CVD diamond-coated stylus showed no evidence of any surface wear or deterioration in measurement accuracy.

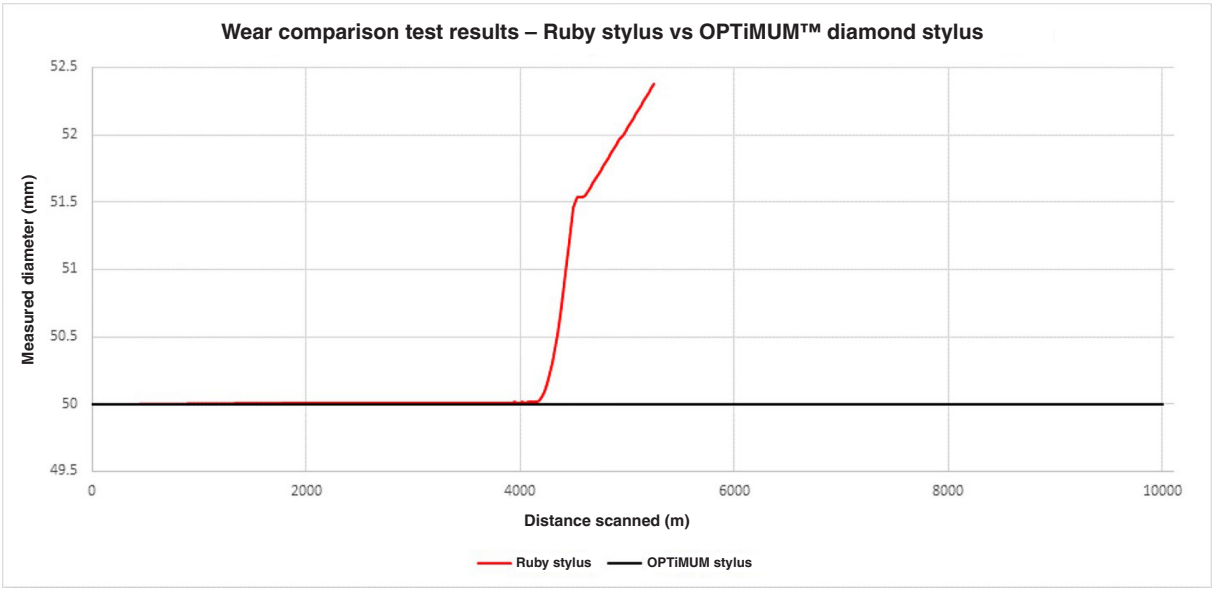


OPTiMUM stylus wear after 10,000 m

Contact us

Built to order, Renishaw OPTiMUM diamond styli are available in multiple thread sizes and stem materials, with ball sizes from 1.5 mm to 8 mm to suit your specific application requirements. The OPTiMUM range supports the increasing need for high performance and speed in scanning applications, coupled with market-leading product availability and price. Contact your local Renishaw representative to find out more.

For more information, visit: **https://www.renishaw.com/styli**



Wear comparison test results – Ruby stylus vs OPTiMUM™ diamond stylus