

Comparison testing between Renishaw OPTiMUM™ diamond styli and the standard ruby equivalent on silicon carbide

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 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 measuring their durability on very hard materials. They were compared to industry-standard ruby styli to demonstrate the difference in wear under extreme conditions.

Silicon carbide was used for the test because it is one of the hardest and strongest ceramic materials available. The test piece had an extremely rough surface finish of 16 Ra, making it highly abrasive.



Figure 1 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.

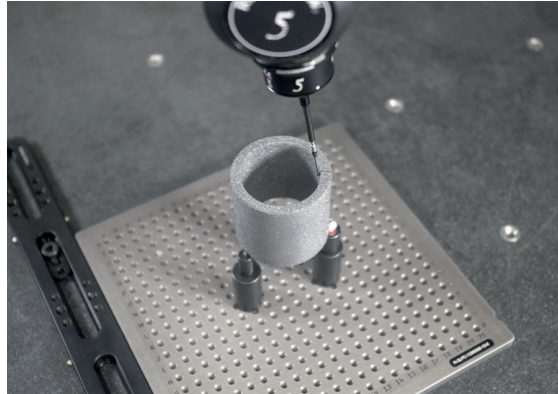


Figure 2 Test conditions in a Grade 1 laboratory using a CMM fitted with a Renishaw REVO 5-axis measurement system.

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 before being put through a series of 25 m scans at a speed of 25 mm/s. This was 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 diamond-coated sphere was used.



Figure 3 Renishaw OPTiMUM diamond styli examples.

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.

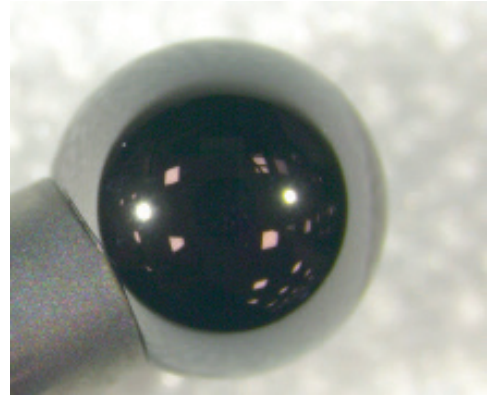
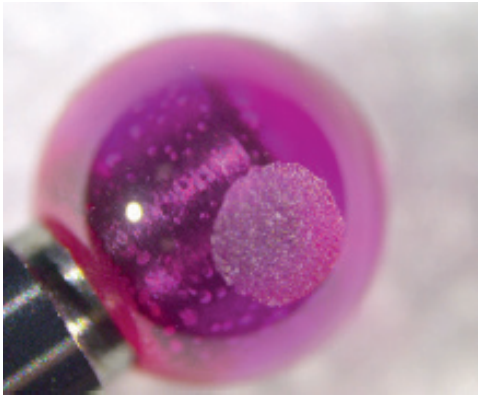
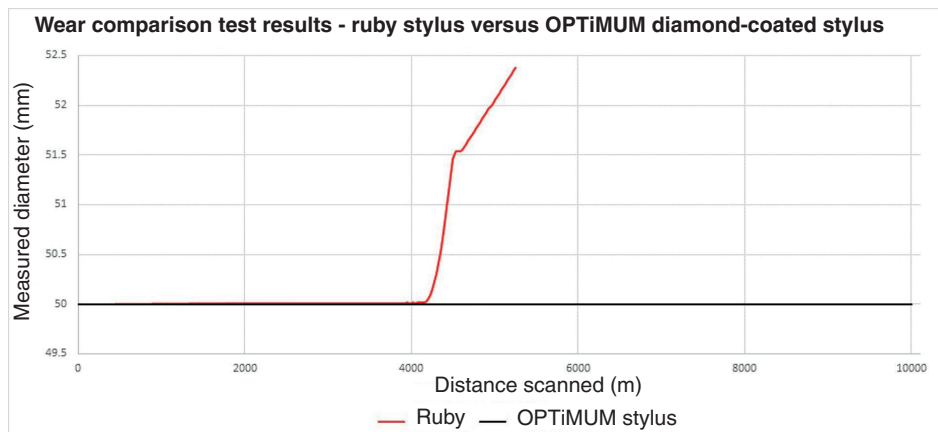


Figure 4 Standard ruby stylus wear after 4,000 m.

Figure 5 OPTiMUM stylus wear after 10,000 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 diamond-coated stylus showed no evidence of any surface wear or deterioration in measurement accuracy.



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