Slurry Abrasion Test (“Miller Test”; ASTM G75)

The international acceptance of this standard ASTM G75 test, ensures that this test is comparable worldwide. The test can be run in two ways, either with a standard specimen or with standard slurry. Standard specimens determine the abrasiveness of the slurry (Miller Number), whereas the standard slurry determines the abrasive resistance of the bulk or coating materials (SAR Number: Slurry Abrasion Response). The wide variety of the solid-fluid-mixture (slurry) according to the application, such as; fluid and mud handling, water pumping and tunnel drilling, etc. provides a big advantage to simulate a particular abrasive cases. The test sample can be subjected to the slurry abrasion process under an oscillating movement to determine the abrasion material resistance. The four simultaneous test samples are clamped into the holders fitted to the four levers and placed in the slurry. The motor-driven rotor produces the oscillating stroke of the sample by the connecting rod driving the four levers (Fig 1). The modification of sample geometry and other parameters is possible. The suspension liquid, as well as, the abrasive quantity, size, quality and materials can be determined upon customer request and based on the real application. The set-up parameters are:

Standard sample geometry:	25.4 x 12.7 x 4.6 - 7.0 mm (2 frontal chamfers 1x15°)
Load:	22.24 N
Frequency:	0.8 Hz
Suspension medium:	Distilled water (standard test), lubricant or additives
Abrasive particles:	F 220 (0.045 - 0.075 mm) Alumina powder (standard test), other abrasives can be also used according to the application.
Test evolution:	The cumulative mass loss can be evaluated after each test interval.

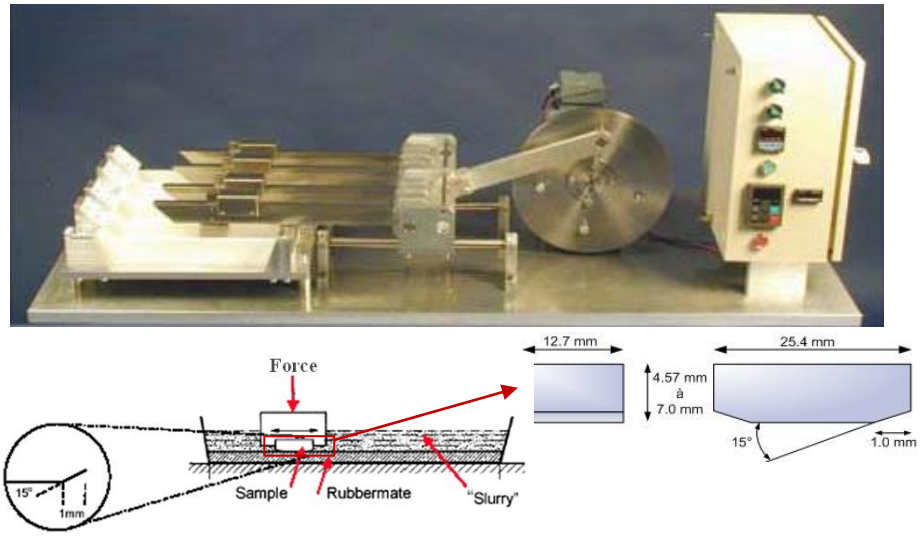

Figure 1: Slurry abrasion test built-up with the testing sample geometry

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Typical Standard Method

ASTM G75: Standard Test Method for Determination of Slurry Abrasivity (Miller Number) and Slurry Abrasion Response of Materials (SAR Number).

This test method covers a procedure to determine, either the relative abrasivity of any slurry (Miller Number) or the response of different materials to the abrasivity of different slurries (SAR Number).

Example of slurry abrasion test:

Cr_3C_2-NiCr thermally sprayed coatings are routinely applied for wear resistance at high temperature up to 830°C. The high wear resistance of this coating is imparted by the hard carbide particles and the high temperature oxidation resistant nature of the matrix (NiCr) and the formation of an oxide scale (Cr2O3). Two kinds of powder based coatings, characterized by a different microhardness, porosity content and phase content were HVOF sprayed at NOVA. The standard abrasive Miller tests were performed for 6 hours with an interval of two hours revealing the mean wear rate in term of mass loss per hour (Fig 2).

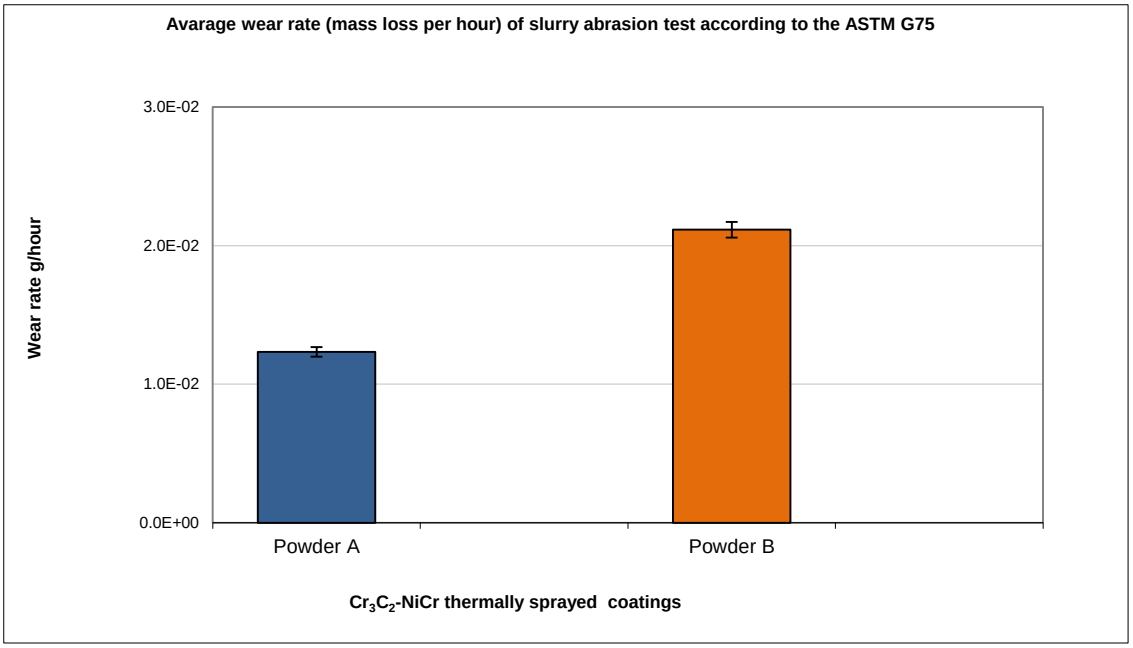

Figure 2: Wear rate of test samples subjected to slurry abrasion ASTM G75, for 6 hours with two hours of intervals.

The morphology of the worn surface and wear mechanisms were investigated by different analytical tools. The topography of the worn surface was scanned using a profilometer based white-light (AltiSurf 500 Cotec) (Fig 3-a), and SEM micrographs were taken to analyse the wear mechanism (Fig 3-b).

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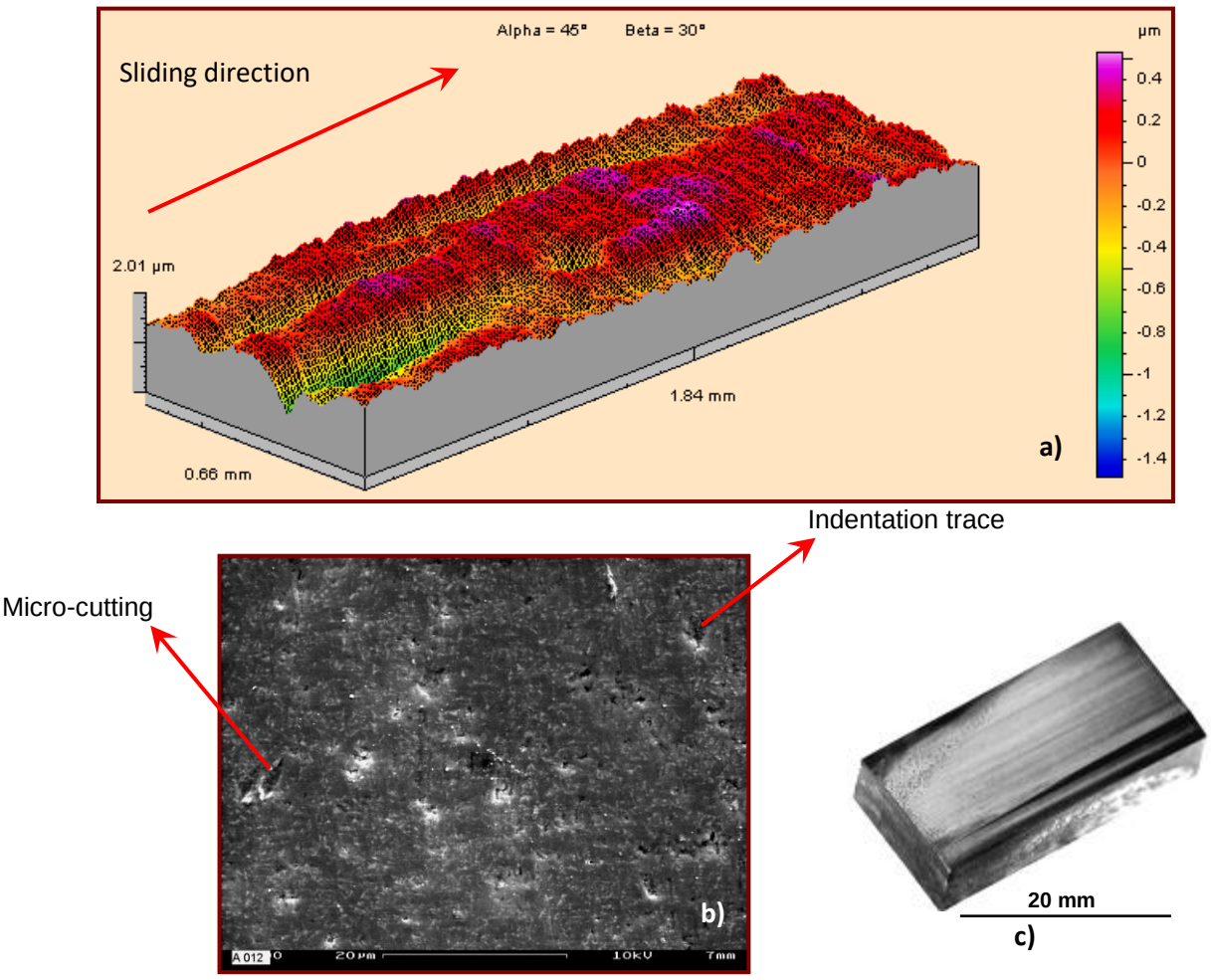

Figure 3: a) Worn surface morphology of thermally sprayed Cr_3C_2-NiCr coating caused by slurry abrasive measured by white-light profilometer (Altisurf 500-Cotec), b) SEM micrograph of the worn surface, c) macrograph of the worn testing sample.

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