

Volume Loss Measurement with Novacam Non-Contact Fiber-Based Profilometers

Keywords: non-contact optical profilometry, NDT measurements, abrasion, wear, hardness, coating thickness, laser-induced breakdown spectroscopy (LIBS), 3D industrial inspection, fiber-based low coherence interferometry (LCI), profilometry, hard-to-reach surfaces

Introduction

Loss of material due to abrasion, erosion, and other types of wear is a common occurrence in industries such as aerospace and automotive. Wear is quantified by measuring volume loss after a wear test or after the use of a tool or component in the field.

Novacam non-contact fiber-based profilometers based on low-coherence interferometry (LCI) are instruments of choice for many volume loss measurements where micron precision is needed. Being fiber based, these profilometers easily measure components of various shapes and sizes, including in hard-to-reach spaces. They are also able to measure the thickness of non-transparent coatings when combined with LIBS technology. Thickness of transparent films and surface roughness can also be evaluated.

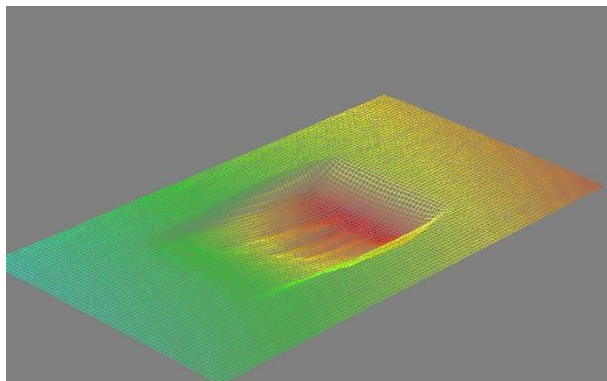


Figure 1: 3D rendering of the scanned surface of a sample (25 x 50 mm) after abrasion



Figure 2: Height image of the surface of the same sample as Figure 1 (color represents depth)

How Volume Loss is Measured

The profilometer acquires the worn region of the sample and the intact region around it. A reference plane is constructed for the intact surface. Volume loss is calculated from the differences between the interpolated reference plane and the actual worn surface.

Dimensions of Scanned Objects

The fiber-based probes of the profilometer are easily displaced on stages or robot arms to scan large objects such as commutators (Figure 3) to small objects several microns in width (Fig. 4).

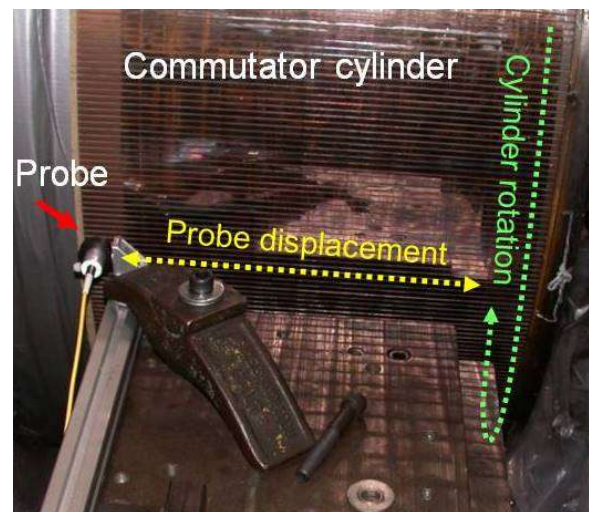


Figure 3: A fiber-based optical probe of Novacam 3D non-contact profilometer scans a commutator, a cylindrical object with several feet of diameter

Measure Coating Thickness Using LIBS with Fiber-Based LCI Profilometry

Laser-induced breakdown spectroscopy (LIBS) is a technique used to identify the atomic structure of a sample. A LIBS device focuses and pulses a powerful laser beam on a sample, vaporizing some material, and then performs spectral analysis on the resulting plasma. Fiber-based LCI profilometry can be used in conjunction with LIBS to measure the depth to which material has been removed. Since the light sources used for both techniques are in the same range, customized devices have been constructed using a common light path configuration. These devices are ideal for measuring non-transparent coating thickness.

Software Application Calculates Volume Loss

Once the profilometer acquires data by scanning the component, specialized software calculates the volume loss. It constructs a reference plane by interpolating to the surrounding area in a square or circular region of interest.

Conclusion

Novacam encourages technicians and engineers in charge of wear or volume loss measurements to contact us to discuss your applications and your particular metrology challenge.

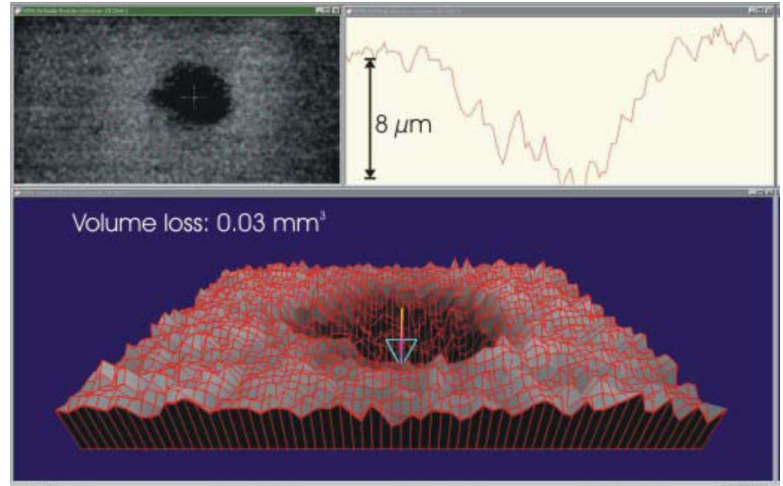


Figure 4: Measurement and volume loss calculation of a crater produced by a LIBS laser

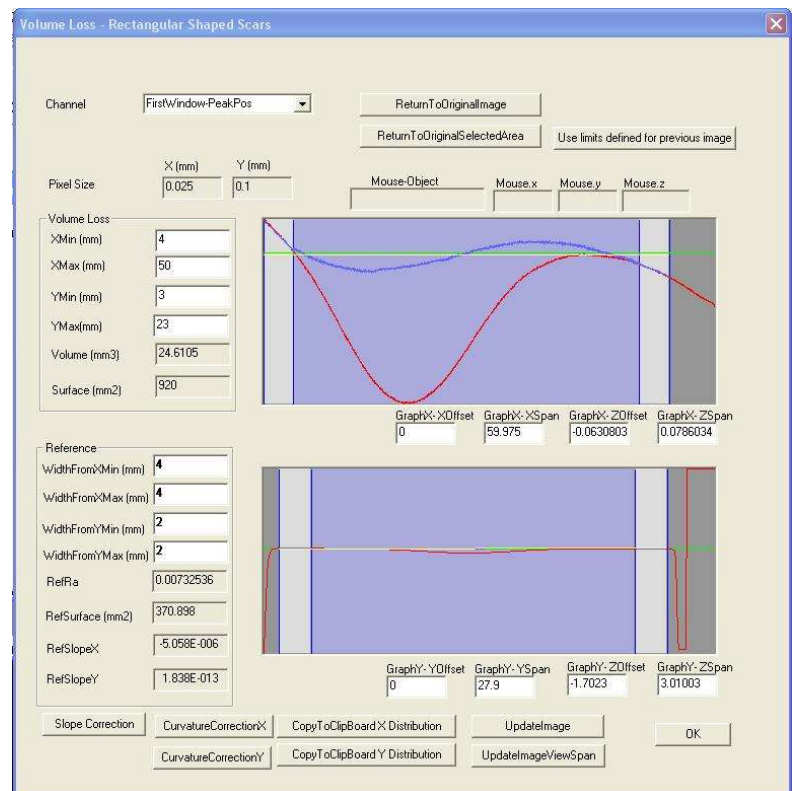


Figure 5: Software display for volume loss analysis



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