Wafer Coating Thickness Measurement
Using 3D Profilometry

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INTRO:

Silicon wafers are widely used in the making of integrated circuits and other micro devices used in a vast number of industries. A constant demand for thinner and smoother wafers and wafer coatings makes the Nanovea 3D non-contact profiler a great tool to quantify coating thickness and roughness of just about any surface. The measurements in this article were taken from a coated wafer sample in order to demonstrate the capabilities of our 3D Non-Contact Profilometer.

IMPORTANCE OF 3D NON CONTACT PROFILOMETER FOR STEP HEIGHT AND ROUGHNESS MEASUREMENT
Unlike other techniques such as touch probes or interferometry, the 3D Non-Contact Profilometer, using axial chromatism, can measure nearly any surface, sample sizes can vary widely due to open staging and there is no sample preparation needed. Nano through macro range is obtained during surface profile measurement with zero influence from sample reflectivity or absorption, has advanced ability to measure high surface angles and there is no software manipulation of results. Easily measure any material: transparent, opaque, specular, diffusive, polished, rough etc. The technique of the Non-Contact Profilometer provides an ideal, broad and user friendly capability to maximize surface studies when step height will be needed; along with the benefits of combined 2D & 3D capability.
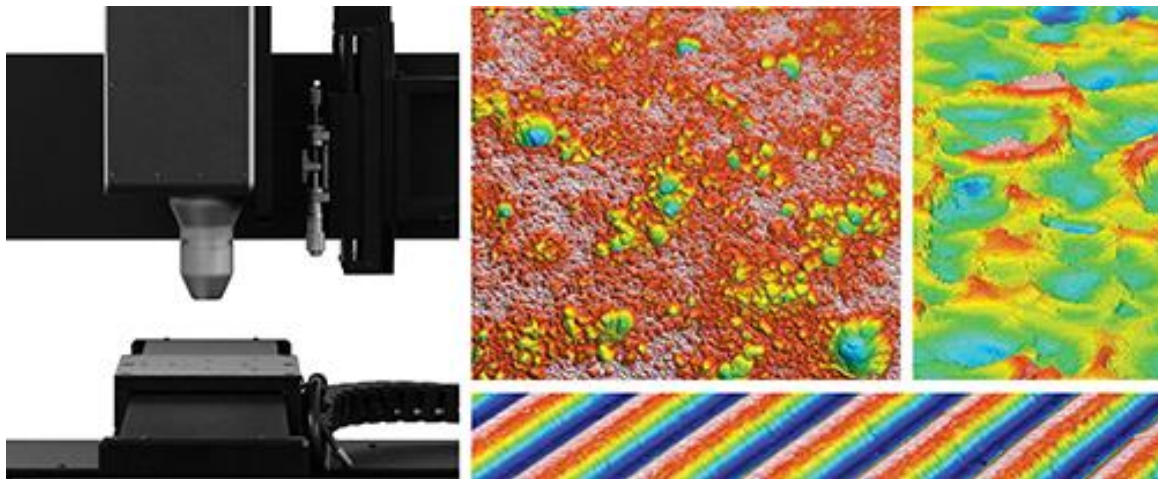

MEASUREMENT OBJECTIVE

In this application the nanovea PS50 is used to measure the step-height of a silicon wafer coating and its roughness. Assuming that the coating thickness is relatively uniform, the coating was removed to expose the substrate in order to measure it as the reference plane. The height of the coating will be measured to characterize the thickness and roughness of the coating.
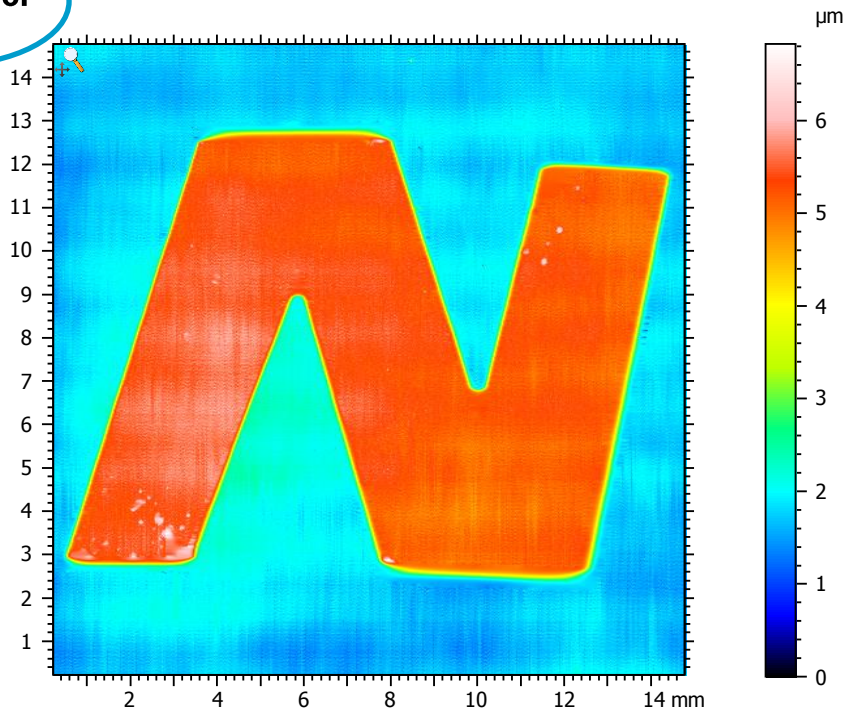
RESULTS: 3D Surface

The 3D View and False Color View of the selected area on the sample surface after the form has been removed. It provides users a straightforward tool to directly observe the distribution and morphology of the surface features from different angles.
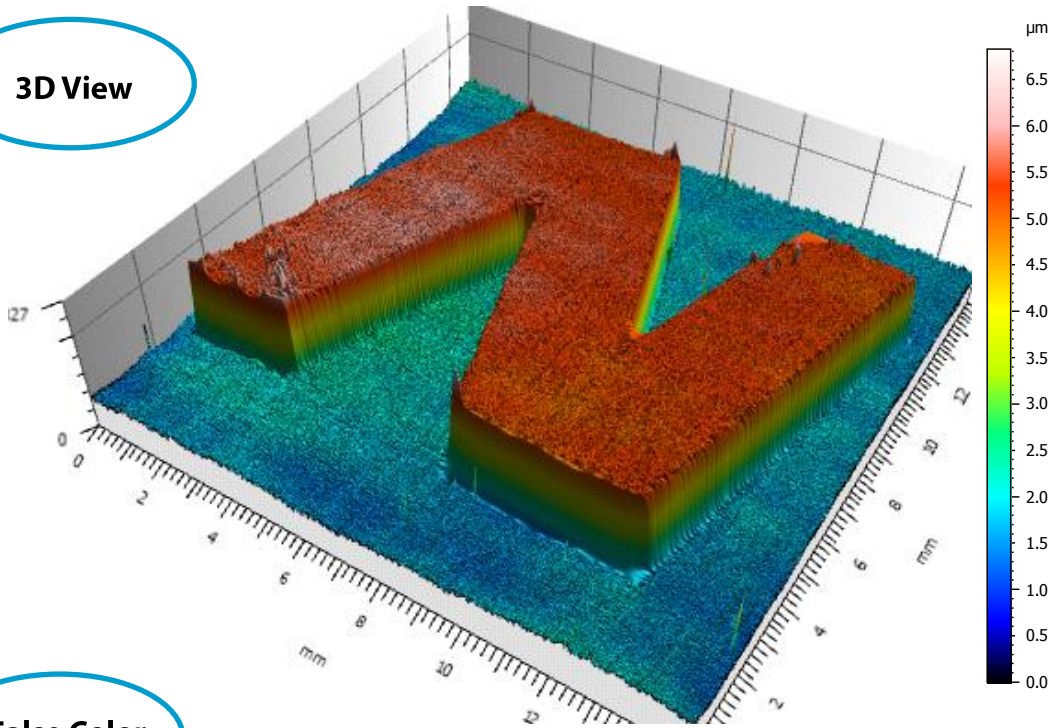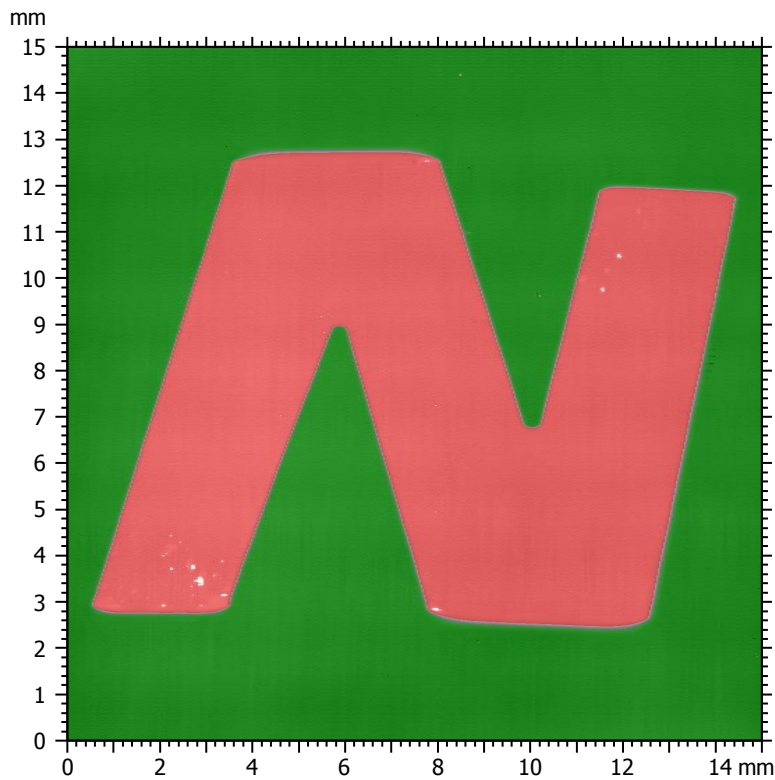
RESULTS: 2D Surface Analysis

The surface features can be quantitified in numerious ways using built-in software tools as shown in the following figures as examples. It can be observed that the average coating thickness is 3.532 µm and has an average surface roughness of 0.111 µm

Area
Step Height

Differential parameters	P2 - P1	Unit	
Zmean(higher) - Zmean(lower)	3.485	µm	

Profile Step Height
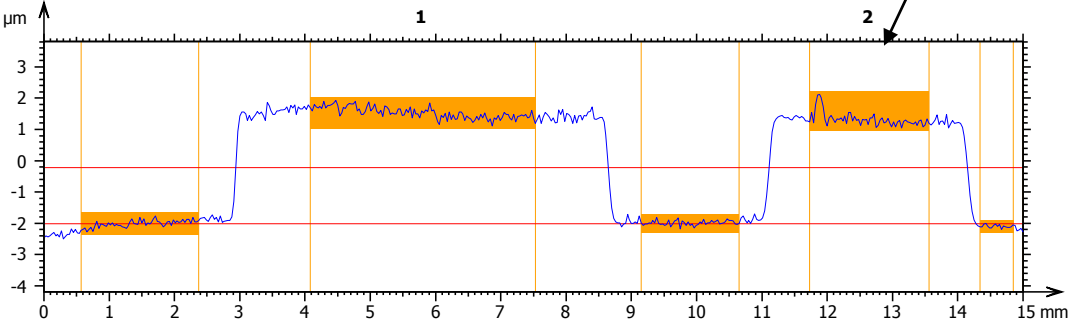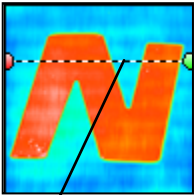
Parameters	Unit	Step 1	Step 2
Maximum height	µm	3.942	4.122
Mean height	µm	3.543	3.340

Surface Area Roughness

ISO 25178		
Height Parameters		
Sa	0.1113	µm
Sz	2.690	µm
Sv	1.515	µm
Sp	1.175	µm
Sq	0.1417	µm
Ssk	0.1406	
Sku	4.189	
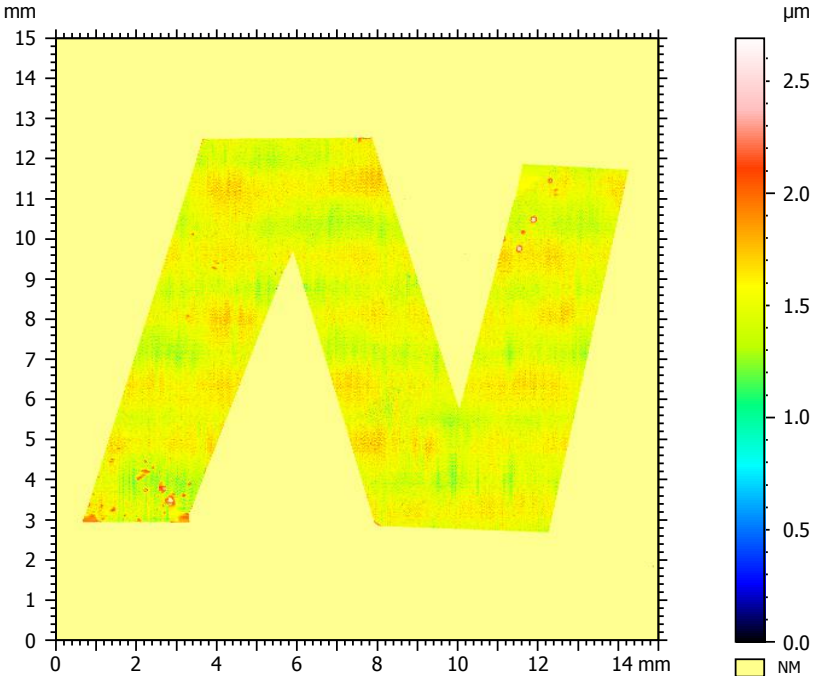
CONCLUSION:

In this application, we have shown how the Nanovea 3D Non Contact Profilometer is capable of precisely characterizing the height and surface roughness of a metal coating. The data shows the coating to have a mean step-height of 3.532 µm and average surface roughness of 0.111 µm. The data shown here represents only a portion of the calculations available in the analysis software.

Learn more about the Nanovea Profilometer or Lab Services