B. Nanometrology
In this activity, we develop methodologies and software for the dimensional and roughness metrology of patterned (XERDEMO software) and open (freeform) plasma treated and otherwise nanofabricated surfaces (surfanalysis software) through the analysis of SEM and AFM images. Exploitation of results may take place via a collaborating spin-off company Nanometrisis P.C. (www.nanometrisis.com)

B1. Nanometrology of patterned structures
(V. Constantoudis and external collaborators)
New methodology has been developed and implemented in XERDEMO software for the characterization of line wiggling and cross-line correlations in Directed Self Assembly and Multiple Patterning Lithography patterns at sub-20nm scales. This is based on the novel metrics of Line Center Roughness and c-factor correlation function and has been applied to the analysis of a large amount of images with line/space structures.
Also, we have examined the impact of Line Edge Roughness of metal lines on the variability of ReRAM memory devices using modeling of LER with fractional Brownian fractal curves.

![Fig.1 Definition of the c-factor function to characterize cross-line correlations for a top-down SEM image of DSA line/space patterning with width<15nm.](image)

B2. Nanometrology of open surface morphologies
(V. Constantoudis, Y. Sioulas and external collaborators)
A novel approach for the characterization of complex surface nanomorphologies has been initiated focusing on the detection of their symmetries (translational, rotational, scaling) and the characterization of the different routes to deviate from and mix them. During this year, we have elaborated the scaling and rotational symmetry. For the first, we have implemented the multifractal formalism for the quantification of the deviation from full scaling symmetry (monofractality) through the estimation of the multifractal spectrum. The multifractal analysis has been applied to plasma treated surfaces and revealed the increased multifractality with treatment time.
Also, we have proposed a new typology of deviations of spatial data from full isotropy along with mathematical parameters for the description of different type anisotropic nanostructures in combination with local and scaling aspects. Since the above approach can be applied to any complex structure in spatial or time domain, we have extended our formalisms to other complex systems such as language to get cross-fertilization benefits.