

# INTERCOMPARISON OF STEP HEIGHT MEASUREMENTS USING AFM, PROFILOMETER AND SEM IN NORTHERN EUROPE

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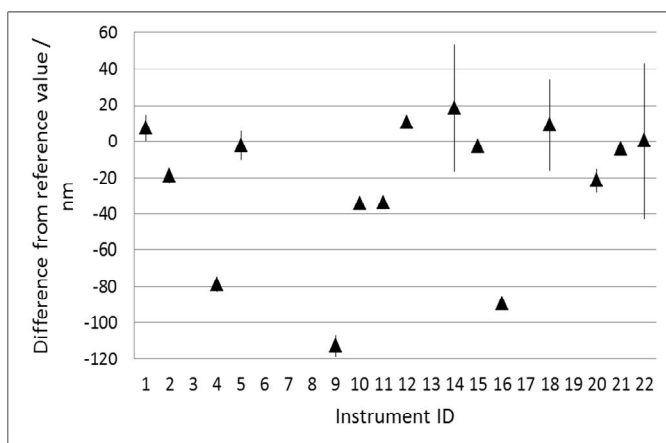
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Traceable scale and realistic uncertainty estimates are needed in all measurements. Without traceability, measurement results are not repeatable or comparable with other results measured in other laboratories, or even with those from the same laboratory performed at different times or with different instruments. High resolution and good internal repeatability of many modern microscopes may give an illusion of high accuracy. Frequent calibration, instrument stability and high resolution are all needed for reliable and accurate measurements. The national metrology institutes in Finland, Sweden, Norway and Estonia organized comparison measurement Nordic-nano2 for AFMs, profilometers and SEMs. The purpose of the comparison was to study measurement capabilities at universities and research institutes and to get information about the calibration of their instruments. Twelve laboratories participated in the comparison. The comparison samples were step height standards with nominal steps of 20 nm, 100 nm and 1000 nm. The reference values were measured with the MIKES metrological AFM [1]. Standard uncertainties for the reference values were from 0.5 nm to 2 nm.

The comparison shows that the measurement capabilities of the laboratories vary significantly. Maximum differences from reference value were 1.1 nm for 20 nm sample, 14 nm

for 100 nm sample and 120 nm for 1  $\mu$ m sample (Figure 1). For 20 nm sample all measurement results except one agreed with the reference value within the stated uncertainties. For 100 nm sample 12/14 results agreed with the reference value, but for 1  $\mu$ m sample only 4/15 agreed with the reference values. The quality of the uncertainty estimates varied between the laboratories, and for some laboratories the appropriateness of the calibration procedures could be considered.



**Figure 1** Differences from the reference value for nominally 1000 nm step height