

SPM-Nanoa™ Scanning Probe Microscope (Atomic Force Microscope)

## 8K High Pixel Resolution Observation Leading You into the Nano World! Simultaneously Achieves Both Large-Area Observation and High Definition Analysis-2

K. Kuroda, S. Moriguchi

### User Benefits

- ◆ With a single 8K high pixel observation, it is possible to check the 3D topography of a wide range and the detailed structure at any given point.
- ◆ There is no need to reacquire data even when checking multiple regions.
- ◆ Patterned substrates can be easily observed and analyzed without the need for pretreatment.

### Introduction

Scanning Probe Microscope [SPM (AFM)] is a microscope that enables easy, high-resolution 3D observation at the nano meter scale in air. The range of application is extensive, from hard materials such as semiconductor substrates and metals to soft materials such as biological samples. As the miniaturization of electronic devices and bio-devices progresses, further miniaturization is required for the parts comprising these devices. For example, in the semiconductor industry, the line width of circuits used to be 10 μm when integrated circuits were first developed, but now it is 14 nm. Even so, since the number of pixels in the conventional SPM was only about 2K (2048 × 2048), it has been necessary to perform measurements at each location when multiple locations were to be observed in detail. On the other hand, SPM-Nanoa, which realizes 8K high pixel observation, can cut out a clear narrow image from a wide image, thus enabling us to observe the detailed structure of multiple locations in a single measurement. In this article, we introduce an example of 8K (8192 × 8192) high pixel observation on a patterned Si substrate.

### SPM-Nanoa

SPM is a microscope that observes and measures the 3D topography and local physical properties of a sample at high magnification by scanning the sample surface with a tiny probe (cantilever). Equipped with an advanced high-sensitivity detection system and automatic observation function as standard, SPM-Nanoa is a new SPM which makes it easier, more detailed, and faster to "observe" what you want to observe. It powerfully assists you in diverse tasks, from observation of the topography of microscopic areas to the measurement of physical properties. Fig. 1 shows the external view of SPM-Nanoa. The three features of SPM-Nanoa are as follows:

- ① Automatic observation:  
Adjusts the optical axis of the laser, sets the conditions during observation, and automates image processing.
- ② Extensive functionality:  
High-resolution wide-area observation with 8K images.
- ③ Saves time:  
Various support functionality achieves fast observation.

This article will particularly introduce 8K high pixel observation, one of the ② Extensive functionality features. SPM-Nanoa enables 8K high pixel observation in the XY plane, allowing high resolution analysis even for images digitally enlarged.



Fig. 1 SPM-Nanoa™ Scanning Probe Microscope

### High Resolution Observation with 8K Pixels

SPM-Nanoa has achieved observation of up to 8K pixels. An 8K image contains the amount of data equivalent to 900 images with pixels (256 × 256) commonly used as standard. This means that it is possible to retrieve an image from any location in any field of view on the image, as well as to digitally magnify a segment of the view to check details while maintaining a sufficient number of pixels. Fig. 2 illustrates the idea of digital magnification.

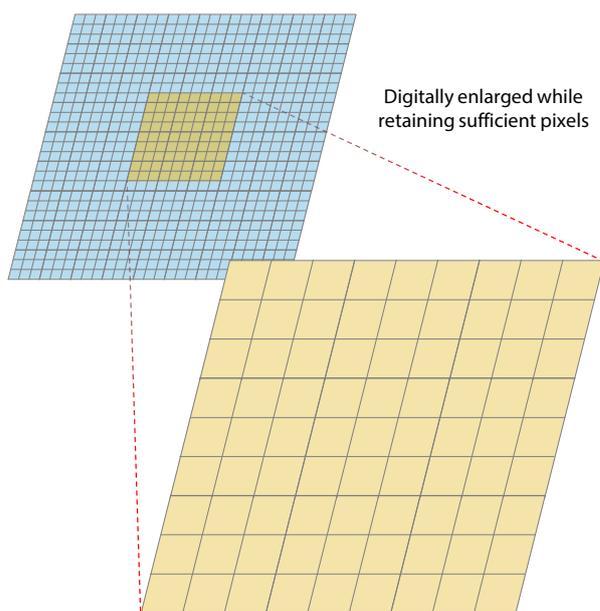


Fig. 2 Digital Magnification

### Observation Sample and Conditions

A patterned Si substrate was observed as a sample. The surface of the substrate is patterned with 20 μm square pictograms and holes with a diameter of 200 nm. Table 1 shows the observation conditions. The observation field was set to 100 μm × 100 μm, allowing for checking the entire appearance.

Table 1 Observation Conditions

Instrument	: SPM-Nanoa Scanning Probe Microscope
Scanner	: Wide range scanner (125 μm)
Observation mode	: Contact mode
Observation field	: 100 μm × 100 μm
Number of pixels	: 8192 × 8192

### ■ Observation Results

Fig. 3 shows the observation results. In the 8K high pixel image in Fig. 3(a), it can be seen that various pictograms are lined up in a  $100\ \mu\text{m} \times 100\ \mu\text{m}$  area. Figs. 3(b) to (f) show the digital magnification of each distinctive shape in the field of view. Fig. 3(b) shows one of the pictograms enlarged. We can observe how the dots are lined up in the area that looked smooth in Fig. 3(a). Fig. 3(c) then shows the image magnified 20 times, clearly capturing even how some of the dots are connected to each other. We can also observe from Figs. 3(d), (e), and (f) that the diameter of these dots is  $200\ \text{nm}$ . In this way, it is possible to confirm 3D topography in a wide area as well as detailed structures in arbitrary locations, based on just one 8K high pixel observation.

### ■ Conclusion

SPM-Nanoa's 8K high pixel observation can cut out a clear narrow image from a wide image, allowing for checking the detailed structure of multiple locations in a single measurement. This new feature, not available in conventional SPMs, will make your "wish to observe" come true.

Sample provided by NanoSensors

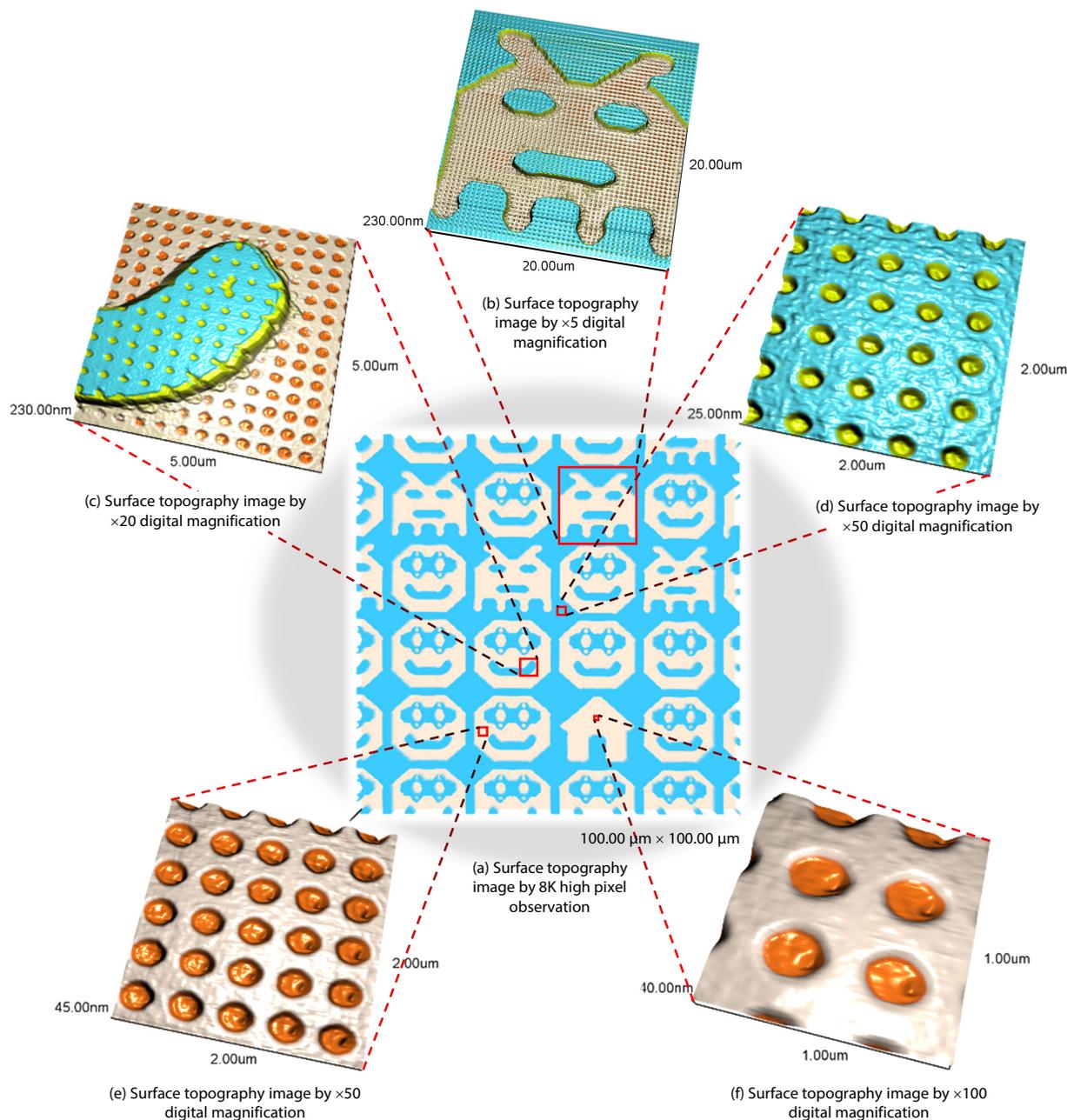


Fig. 3 Results of 8K High Pixel Observation

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