NANONIS TECHNICAL NOTE

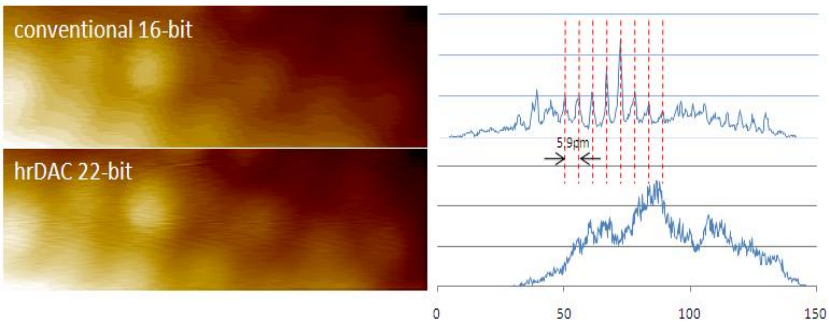
22-bit ON ALL OUTPUT CHANNELS: NANONIS hrDAC™

In digital SPM control system the resolution of the digital-analog converters has always been a limiting factor, both in achieving atomic resolution and in spectroscopy applications. The newly developed hrDAC™ not only overcomes these limitations, but compared to the usual offset/gain approach, also has a series of other advantages:

- **No Limitation in z-range**: Excellent atomic resolution even over multiple step-edges.
- **No Inconsistent Scales:** One scale over the whole piezo range, no offset and gain problems.
- **Unlimited Resolution in Spectroscopy**: No need for additional dividers in bias spectroscopy.
- **Extremely simple Handling:** automatic calibration routine, once installed, no need to think about it anymore.

The patented hrDAC™ technology puts an end to offset and gain. The high resolution is not limited to one channel only, but is available on all eight output channels, including Bias and Z.

hrDAC™ is an advanced digital dithering techniques combined with hardware filtering to achieve smooth transitions between the 16-bit steps of the output. The dithering is done at several hundred kilohertz, so the low-pass filters screen out all high frequencies.



The scan shows atomic resolution on a NiAl(110) with hrDAC on (below) and off (above). The histogram clearly shows the 16-bit steps when hrDAC is switched off. Data courtesy of Dr. Markus Heyde, FHI Berlin, Germany.

hrDAC™ is available to all our customers, even if they bought the system more than 5 years ago. The implementation is purely digital and can be deployed as a simple software upgrade.

Authors

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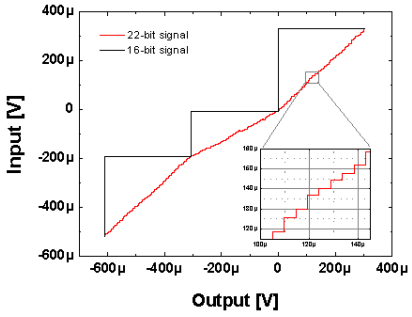

Input connected directly to output, the sweep shows the output resolution in the case of a regular 16-bit converters versus the performance of hrDAC™ at 22 bits. The resolution achieved is available on all channels, for scanning as well as spectroscopy.

Nanonis Modules in Use:

- Base Package

System:

- Any system

NANONIS
The SPM Application Experts

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