

Piezoresponse AFM Test Grating

A regular structure of ferroelectric domains having different polarization can be used to test AFM in Piezoresponse Force Microscope mode, adjust the amplitude and phase of piezoresponse and set other scanning parameters to optimal values.

The grating is cut from a single crystal of LiNbO_3 perpendicular to its polar axis. A periodic domain structure is formed in the bulk of the sample, where the spontaneous polarization is perpendicular to the surface and opposite in the neighboring domains. The direction of polarization determines the sign of the piezoelectric coefficient. Analysis of piezoresponse to externally applied electric field allows visualizing the distribution of the polarization over the surface.

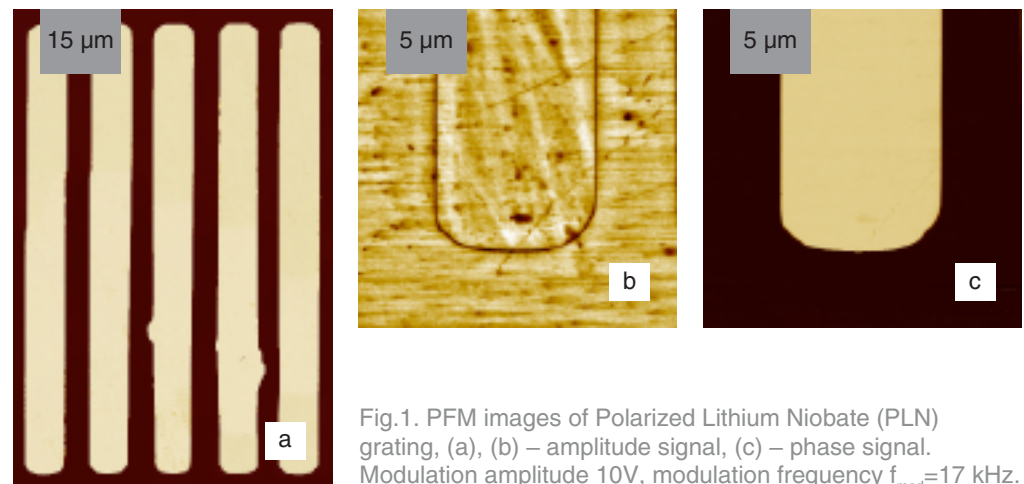


Fig.1. PFM images of Polarized Lithium Niobate (PLN) grating, (a), (b) – amplitude signal, (c) – phase signal. Modulation amplitude 10V, modulation frequency $f_{\text{mod}}=17$ kHz.

Specification

The grating of Polarized Lithium Niobate (PLN) has a sputtered electrode on the backside and is attached to a metal substrate by copper adhesive tape. The work surface is polished to roughness less than 10 nm.

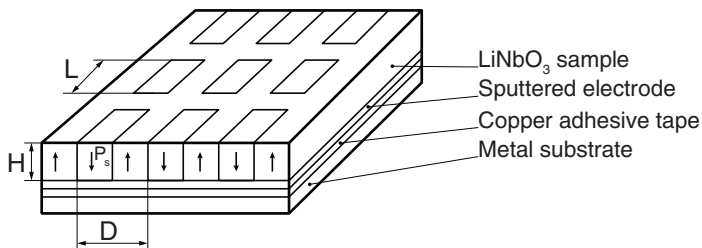


Fig.2. Schematic drawing of PLN grating.

| | |
|----------------------|-------------------|
| Chip size | 5x5 mm |
| Grating thickness, H | 0.5 mm |
| Domain period, D | 15 μm |
| Stroke length, L | 100 μm |
| Surface roughness | Less than 10 nm |

How to use

Piezoresponse Force Microscope is a contact mode technique, where AC voltage is applied to conducting AFM probe at frequency f_{mod} . The bottom electrode of the grating should be grounded. Because of the piezoelectric effect the surface of the sample starts oscillating at the same frequency f_{mod} . The response of the surface is analyzed by a selective lock-in amplifier. The domains are visualized in amplitude images, while the borders of the domains can be seen in phase contrast (See Fig.1.)

Artech Carbon OÜ

Jõe 5, 10151 Tallinn, Estonia
 Tel: +372 630 77 00
 Fax: +372 630 77 99
 Mobile: +7 926 295 68 32
 e-mail: info@scdprobes.com