Thermal Lithography for 100 nm Fabrication Pattern

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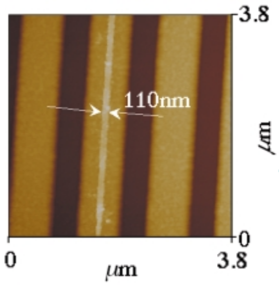
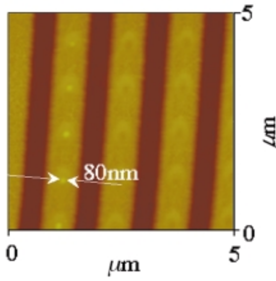
We have succeeded in patterning narrow lines and dots with 100 nm dimensions in a photoresist film by a “Thermal Lithography” technique using a semiconductor laser with 635 nm wavelength. We utilized a focused laser spot to produce a spatially confined hot spot in a phase change recording layer on a polycarbonate optical disk substrate. This hot spot induced a thermal cross-linking reaction in an adjacent photoresist film. By optimizing the sample rotation speed and the laser power, we were able to reduce the spot size where the thermal cross-linking reaction in the photoresist occurred and patterned extremely fine structures.



Topography of a narrow photoresist line produced by continuous laser mode.



Dots image produced by pulse laser mode.

Quantum-size Effects in Magnetic Tunnel Junctions

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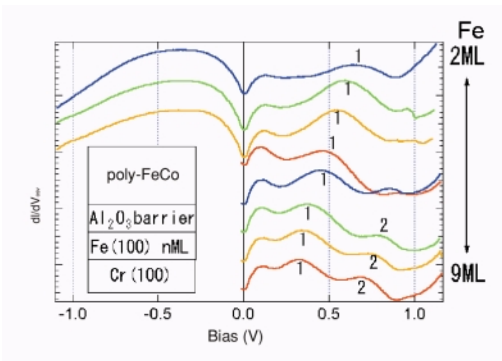
We prepared the magnetic tunnel junctions which have single-crystal ultrathin Fe electrode, and measured the tunnel spectra and magnetoresistance. As a result, the MTJs with ultrathin Fe electrode showed the oscillatory behavior in the positive bias field, and the magnetoresistance showed the oscillations also. These results indicate the existence of the quantum-well states in the ultrathin Fe electrodes. This is the first observation of the quantum-well effect in the bias dependence of TMR. This new effect provides us with a possibility to create new spintronics devices.



Oscillatory components of the differential conductance of MTJs with ultrathin Fe (100) electrode for various thickness Fe (100) electrodes;Cr(100)(30nm)/Fe(100)(nML)/Al-O(1.7nm)/FeCo(20nm).