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Effect of Energy Levels of Organic Resist on Atomic Force Microscope Lithography

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In atomic force microscope (AFM) anodization lithography, it is not clear how tunneling process is accomplished. After an AFM tip is approached to the resist surface, the anodization process is controlled by a tunneling current. Accordingly, this phenomenon is as same as tunneling process STM - resonance tunneling from a tip to a substrate via sample and metal - semiconductor contact. In this lithography mechanism, the threshold voltage for causing anodization is affected by the energy levels of a tip, Si substrates and the energy band gap of conducting organic resists. In this study, we have investigated the effect of the energy-level of metal coated tip and organic resists when other lithographic parameters are fixed. The Tetrathiafulvalene (TTF) and Bis(ethylenedithio)tetrathiafulvalene(BEDT-TTF) were used as organic resists for AFM anodization lithography. The lithographic starting voltage depends on the energy levels of tip and resist, and the threshold voltages of TTF and BEDT-TTF were found to be 8 V and 4 V based on our experimental data. The applied current during the anodic reaction was monitored by scanning tunneling spectroscopy.

