HIGH-SPEED FABRICATION OF NANOSTRUCTURES USING ATOMIC FORCE MICROSCOPE LITHOGRAPHY

Sukjong Bae, Soonwoo Lee, Cheol Hong Park, Seunghyun Lee, Haiwon Lee
Department of Chemistry, Hanyang University
17 Haengdang-dong, Seongdong-gu, Seoul 133-791, Korea
haiwon@hanyang.ac.kr

ABSTRACT

The capability to produce nanostructures is essential to modern science and technology related to molecular electronics. From the viewpoint, nanolithography is recognized as a powerful technique to visualize the fabrication of nanoelectronic devices. Therefore, the ongoing miniaturization in size and integration of electronic and mechanic devices has led to an interest in the state-of-the-art lithographic development. The fabrication of nanostuctures and devices can be performed using an ultra-sharpened probe of scanning probe microscope , and atomic force microscope (AFM) lithography is one of the most promising methods for fabricating nanostructures on organic thin films or on solid substrates itself in nanometer scale. AFM have been used primarily to obtain topographic and electronic surface maps. Nowadays, AFM is also being used to fabricate patterns and structures in nanometer scale, as well as to modify chemical or physical structure of surfaces directly.

AFM lithography using a sharpened tip of an AFM with the highest spatial resolution has demonstrated outstanding capabilities for molecular-level manipulation and selective writing patterns on various substrates. We have investigated AFM anodization lithography for several years. There are several factors influencing to AFM anodization lithography. The lithographic scan speed [and] the electron exposure time are important kinetic factors in local oxidation of surface. And the humidity and bias voltage also affect to determine the size of oxide patterns. Furthermore, the selection of an appropriate functional group of resist materials is a key factor in controlling the line-width of patterns and improving the limit of lithographic scan speed. The resist film should be prepared in a thin and uniform layer to attain a high resolution in nanometer scale. Spin-cast mono- and polymers and self-assembled monolayer have been used for fabrication nanostructures as a novel molecular resist. This presentation will be focused on resist materials, process conditions, and pulse modulator that can achieve the high-speed AFM lithography.