# Direct write electron beam patterning of DNA:complex thin films

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In the last several years there has been increasing interest in obtaining spatially defined regions containing various biopolymers. In particular, DNA patterns are of interest in both biomedical applications[1] and electronic/photonic[2] applications.

We report on the first use of direct write electron beam patterning (DW-EBL) of nanoscale DNA:complex materials. DNA:complex thin films with thicknesses ranging from 85 to 300 nm were prepared by spin coating. The spin coating parameters have been determined for this material for 1, 3, 5, 10, and 12 wt % DNA:complex solutions (Fig. 1). DW-EBL was conducted using a Raith 150 DW-EBL system. The resulting exposed areas demonstrated both positive and negative resist properties depending on development solution (Fig. 2). The characteristics of the DNA:complex material as a patternable electron sensitive resist medium will be presented for different exposure conditions, development conditions, structure size, and structure complexity. It has been shown that complicated patterns such as the Raith Inc. demo pattern (Fig. 3) and nanometer scale features (Fig. 4) are possible using this method.

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[1] R. A. Young, Cell, **102**, 9 (July 2000).
[2] A. J. Steckl, Nature Photonics, **1**, 3 (Jan. 2007).

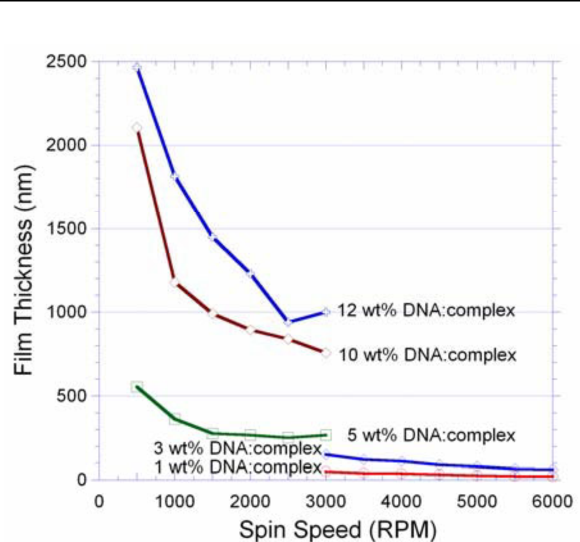


Fig. 1 DNA:complex thin film spin parameters.

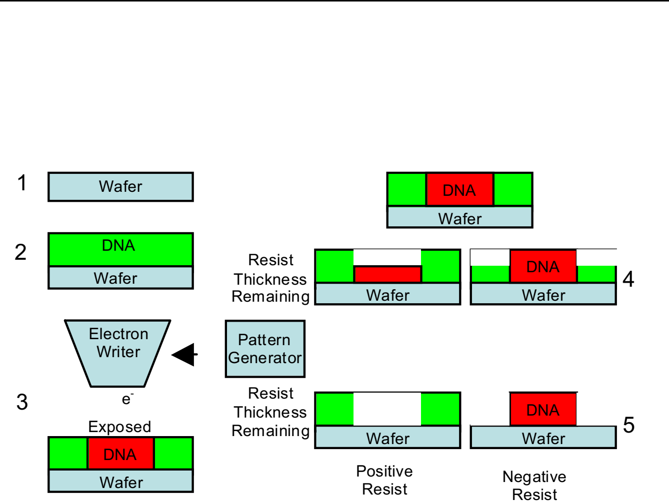


Figure 2. DW-EBL patterning process of DNA:complex thin films.

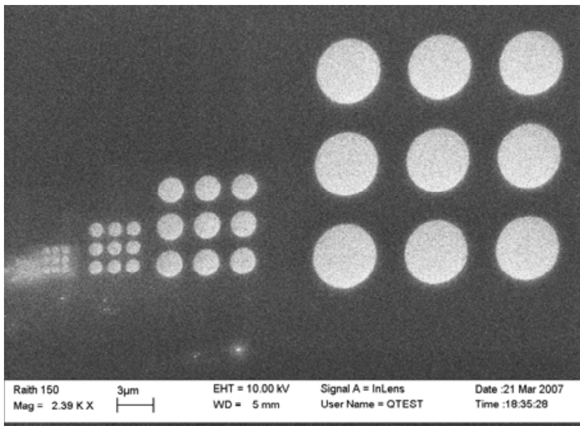


Figure 3. SEM micrograph of ‘positive-resist’ style features (holes) of 5 μm, 2μm, 1μm, 500 nm and 200nm diameter in DNA:complex thin film.

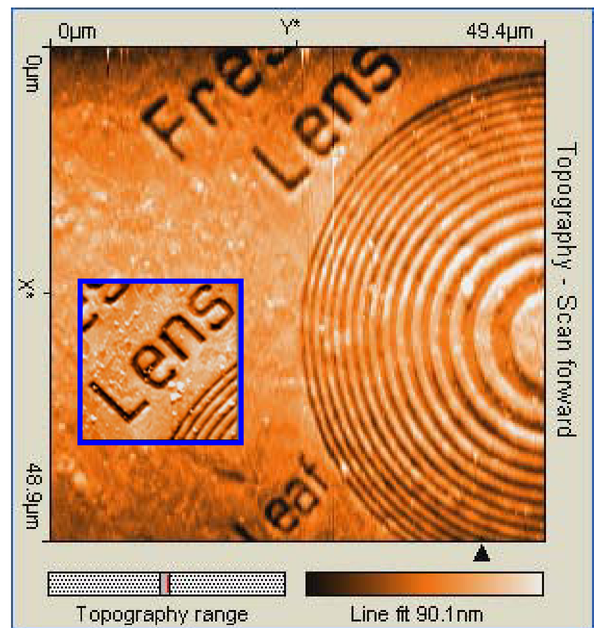


Figure 4. AFM of ‘positive-resist’ style DNA:complex film (85 nm) exposed with the Raith USA demonstration pattern featuring the Fresnel lens portion of the pattern.