>1 Tdot/in.^{2} Bit Patterned Media Template Fabrication by Directed Polymer Self-Assembly

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As current perpendicular recording technology is approaching its limitation at 1 Tdot/in.^{2} around due to the superparamagnetic effect, hard disk drive industry is looking into so-called next-generation magnetic recording technologies, such as heat-assisted magnetic recording and bit-patterned media (BPM). As the critical stage to set the resolution or areal density of BPM systems, BPM templates, used for nanoimprint mold fabrication or frontier patterned media study, are usually generated by e-beam lithography or self-assembly, while other lithographic methods may not be widely accepted at this moment due to insufficient resolution capability. Unlike e-beam lithography depending on not only resist materials but also available high-precision electron beam systems, self-assembly has more versatile material selection and perhaps more resolution-extendibility potential. As studied before[1], self-assembled block copolymers may be able to fulfill the dot size/positioning accuracy requirements of BPM templates with the assistance of existed substrate topographical patterns. However, new block copolymer systems, other than well-known polystyrene-*block*-polymethylmethacrylate, need to be explored to enable high-quality dot patterns with sub-25 nm center-to-center spacings. Here we demonstrate a well-defined nanodot array with a 23 nm spacing (corresponding to 1.4 Tdot/in.^{2}), by using a hybrid organic-inorganic block copolymer system, as illustrated in Fig. 1. Various factors affecting the perfection of self-assembled patterns will be discussed. In addition, the integration of this block copolymer system into the fabrication of nanoimprint molds is examined.

Reference:

1. S. Xiao et al., *J. Vac. Sci. Technol. B* **25**, 1953 (2007)

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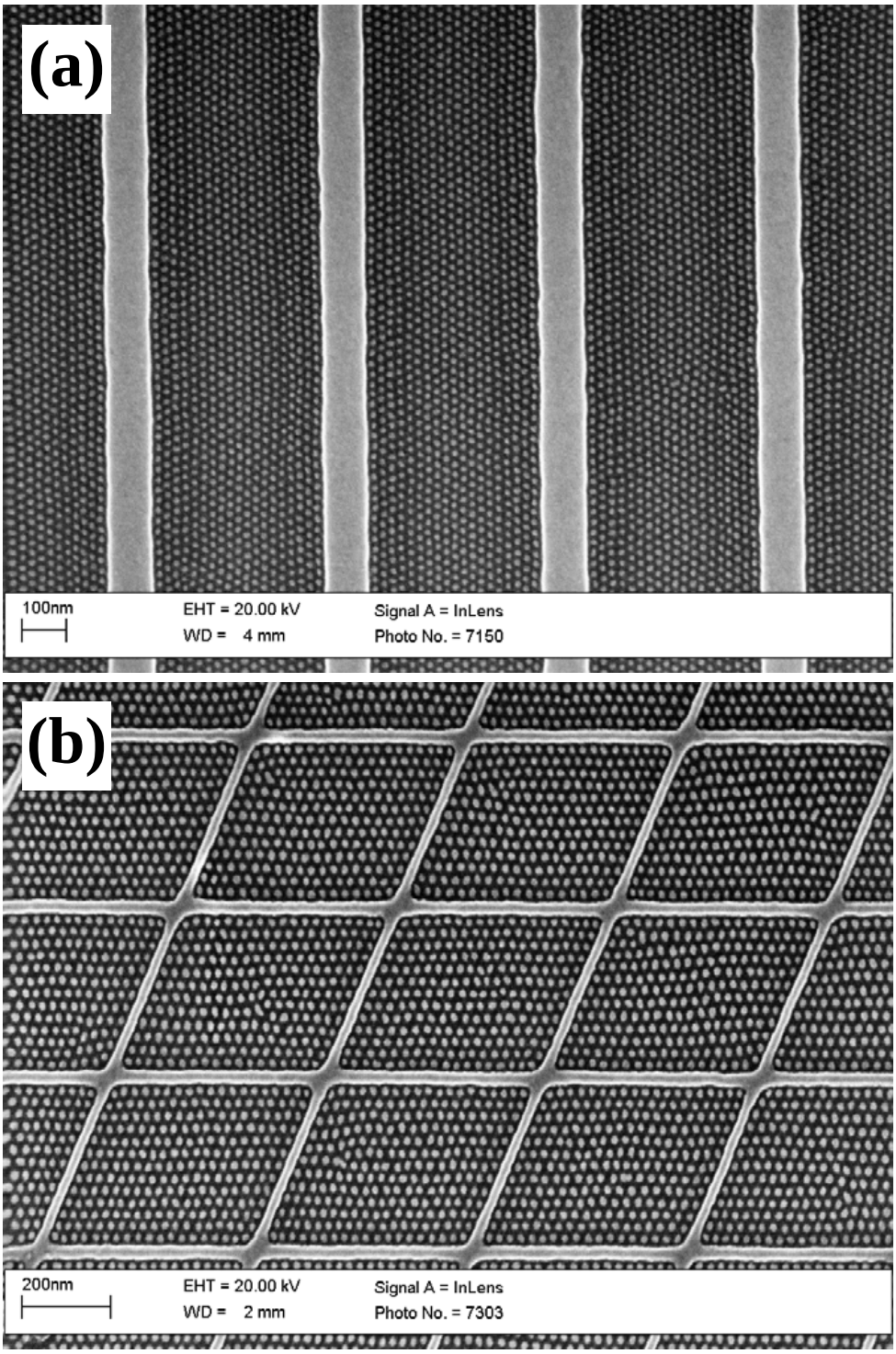

Fig 1: Graphoepitaxial block copolymer nanodot domains with a 23 nm center-to-center spacing, confined in (a) 1-D topographical substrate patterns, and (b) 2-D topographical substrate patterns.