Fabrication of Si nanotemplate using nanosilver colloids for anti-reflection films.

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Recently, there has been much interest in developing cost-effective large-area fabrication methods for nanostructures due to the enhanced performance, particularly in optical applications, such as antireflection windows, advanced light emission, and absorption devices. Indeed, it can improve the optical performance, because if the nanostructure has a distribution of particle sizes, it can affect a wider spectrum of light. The most common methods for the fabrication of nanostructure arrays in the laboratory include laser interference lithography [1], aluminum anode oxide [2], plasma exposure [3], colloidal (nanosphere) lithography followed by dry etching [4], and repetitive replication of master patterns via nanoimprint. Some nanoscopic structural randomness is tolerated in the optical devices that are closest to commercialization.

In the present work, we propose an alternative colloidal lithography using nanosilver colloids in the range of 10~30nm diameter to make the etch mask for wafer-level nanotemplates. The formation of non-close packed nanosilver islands for etch mask was thermodynamically driven by the simultaneous involvements of both dewetting and Ostwald ripening. It depends on various process parameters such as as-received colloidal size, concentration, spin speed, annealing conditions, and so on. As a result of reactive ion etching of the nanosilver etch mask, we achieved random array of nanopillar in the range of 50~100nm with the aspect ratio greater than one after the optimized etching and wet-removal of nanosilver aggregates in figure 1, which imprinted on the UV curable polymer coated on glass. Then, we investigated the AR(antireflection) effect of the nanoimprinted samples. Their transmittance properties increased, whereas the reflectance substantially reduced by around 20% in comparison with bare glass.

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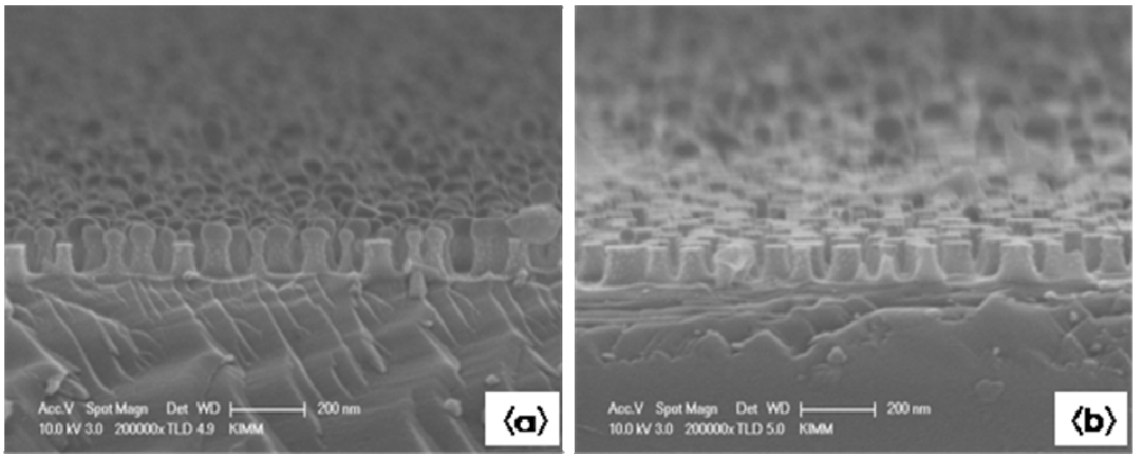

Figure 1. Array of non-close packed nanosilver islands in large area nanotemple for anti-reflection. <a> Cross-section view after etching process by C_4F_8 and SF_6 for 60sec, <b> Cross-section view after removing residue layer

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