

Fabrication of TiO₂ Nano Patterns using Direct Imprinting with TiO₂ Sol

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TiO₂ has been studied intensively for the application of photocatalytic and photovoltaic devices.¹ Due to unique characteristics of TiO₂, it has been used as the material for dye sensitized solar cells, photonic crystals and gas sensors.^{2 3 4} For those applications, nano-sized patterns of TiO₂ can be used more effectively. In order to form the nano-sized TiO₂ pattern, series of processes, including deposition of TiO₂, photo or e-beam lithography process, reactive ion etching and ashing process, are required. New fabrication process of TiO₂ nano-patterns using nanoimprint lithography (NIL) and Sol-Gel method was presented. Ethanol based TiO₂ sol was prepared using tetrabutylorthotitanate as precursor⁵ and used as an imprint resin. As an imprint stamp, replicated PDMS mold was used. During the imprinting process at 5atm and 200°C for an hour, TiO₂ sol was changed to TiO₂ gel by absorbing the solvent to PDMS mold. After imprinting, TiO₂ gel pattern was formed on oxidized Si wafer. According to SEM, TEM, AES and XRD analysis of TiO₂ pattern, It was confirmed that patterns of the master template was transferred to polycrystalline TiO₂ patterns, and TiO₂ gel patterns were finally converted to inorganic polycrystalline TiO₂ patterns by subsequent annealing.

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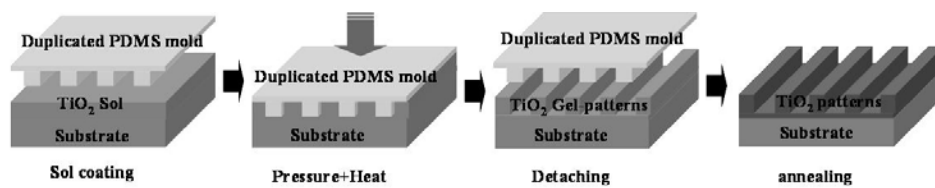


Figure 1. Schematic illustration of overall Sol-Imprinting process.

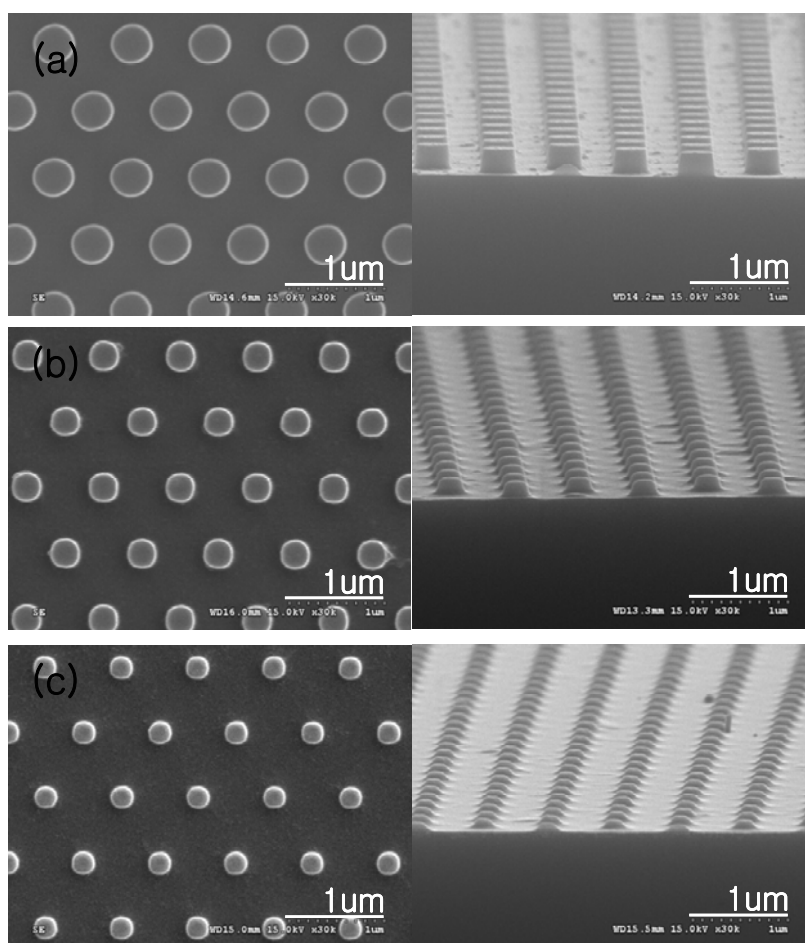


Figure 2. SEM image of (a) the master template, (b) TiO_2 gel-pattern after imprint and (c) TiO_2 pattern after annealing at 700°C .