Controllable formation of Si nano-pillar array for silicon membranes

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Currently, there has been increasing interest in controllable formation of silicon membranes for the wide applications in the fabrication of micro-hotplates for local thermal isolation, bulk silicon micromachining for sensor, and the portable power fields. Although there have been attempts to fabricate the silicon membranes on p-type or n-type silicon substrate, the controllable formation of Si nano-pillar array for the silicon membranes still remains a significant challenge. In this work, we demonstrated a technology for the formation of silicon membranes on pre-defined areas which consists of Si nano-pillar array. For this work, plasma etching was used for the formation of Si nano-pillar array from Cu nano-dot mask. Cu nano-dot mask was formed by rapid thermal treatment of Cu layer deposited on Si substrate using thermal evaporation. We investigated the main process parameters to obtain Si nano-pillar array from Cu nano-dot mask. Finally, the developed technology was used to form silicon membranes on the silicon substrate for microelectromechanical systems (MEMS)-based fuel cell.