Development of Novel Microfluidic Cryo-EM Microchip for Structure Analysis of Nanomaterials

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Micro electromechanical system (MEMS) technology has allowed to fabricate microfluidic devices with complicated designs for various applications. The microfluidic device can be applied for transmission electron microscope (TEM) to investigate structure of nanomaterials in liquid phase using cryogenic electron microscopy (cryo-EM). Cryo-EM has emerged as the preferred method to analyze structure of nanomaterials in liquid state. Despite the major advances in the overall cryo-EM workflow, the process of preparing samples still persists as the major bottleneck to utilize full potential of cryo-EM. It is difficult to control the thickness of the vitreous ice that embeds nanoscale specimens, depending on the size and type of materials of interest. Herein, we develop an advanced silicon (Si) chip-based device which has a regular array of micropatterned holes with a graphene oxide (GO) window on free-standing silicon nitride (SixNy). Accurately regulated depths of micropatterned holes enable precise control of vitreous ice thickness which provides stable cryo-EM imaging for various nanoscale materials.