# Patterning Nano-Domains with Orthogonal Functionalities: Solventless Synthesis of Self-Sorting Surfaces

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Surfaces covered by well-defined organic functional groups can serve as platforms to immobilize molecular species such as fluorescent dyes or peptides, as well as particles, including quantum dots and metal nanoparticles. Reaction with the organic functional group is desired to provide high selectivity and strong binding of the desired component onto the synthetic surface. Immobilization schemes for molecules and particles combined with micropatterning techniques promise to be enabling methods for novel device fabrication. However, the solvents employed in conventional patterning techniques often result in dissolution or delamination of the functional layer. Additionally, the solvents and/or irradiation methods employed by traditional patterning schemes often degrade the activity of the desired organic functional groups. Click chemistry active surfaces were successfully deposited using the novel one-step synthetic process of initiated chemical vapor deposition (iCVD) using the commercially available monomers. Bilayers of click-active iCVD films on top of amine-containing films were patterned by capillary force lithography to obtain dual functional nano-patterned surfaces having a minimum feature size of 110 nm. Exposing the patterned surface to a mixture of two fluorescent dyes resulted in self-sorting of the dyes via conjugation of the dyes onto selected areas of the pattern. Utilizing two functional layers displaying orthogonal reactivity enables sorting of aqueous mixtures of dyes and nanoparticles, such as quantum dots, onto selective areas of nanopatterned surfaces. The characteristics of the iCVD thin film growth method include the retention of reactive organic functional groups, compatibility with conventional silicon device and MEMS fabrication schemes, the ability to produce thin films which are conformal over micro- and nano-features, and facile nanopatterning schemes. We anticipate these features will make iCVD a powerful integration platform for organic and nanoparticle functionalization into next generation devices.