

Selective Growth of Iron Oxide Thin Films Using Iron pentacarbonyl on Si(100) substrate

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We have carried out the selective deposition of iron oxide thin films on silicon substrates, Si(100), using a combined method of thermal MOCVD (Metal-Organic Chemical Vapor Deposition) and micro-contact printing (CP) technique. First, we made self-assembly monolayers (SAMs) with micron dimension of octadecyltrichlorosilane (OTS) on the Si(100) substrate by using of CP method. In this process, the CP technique showed that hydrophobic patterns with micro dimensions were able to be formed on hydrophilic surfaces. After that, iron oxide thin films were deposited on the substrates by thermal MOCVD method using single molecular organometallic precursor of iron pentacarbonyl ($\text{Fe}(\text{CO})_5$) with high purity (99.999%) oxygen gas. The deposition was carried out in the range of 250-350°C for 1 h ~ 2 min. under 1×10^{-2} Torr vacuum condition in a home-made MOCVD system. In order to check the selectivity of as-deposited thin films optical microscopy (OM), scanning electron microscopy (SEM) and atomic force microscopy (AFM) analyses were performed. To confirm the crystallinity of deposited thin films, X-ray diffraction (XRD) patterns were studied. Also energy dispersive X-ray (EDX) and X-ray photoelectron spectrometry (XPS) results showed the composition of the as-grown iron oxide thin films. By means of these results, we can suggest that the selective deposition mechanisms and tendencies of iron oxide thin films onto the OTS patterned Si(100) surfaces.