Short Communication

Construction of TiO₂/Si Heterostructure by Nanoepitaxial Growth of Anatase-type TiO₂

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Nearly defect-free interfaces can be formed using two lattice-matched semiconductors and nanoepitaxial growth methods that can be controlled at the atomic level. In this work, the nanoepitaxy of anatase-type TiO₂ on crystalline silicon substrates for fabricating TiO₂/Si heterogeneous interface is demonstrated by combining self-assembly and hydrothermal methods. Solid-phase nanoepitaxy is formed in this heterogeneous interface according to the crystal type and crystal lattice matching between anatase-type TiO₂ and crystalline silicon. X-ray diffraction (XRD) and crystal symmetry indicate that the nanoepitaxy growth of anatase-type TiO₂ on the Si (001) plane is (001) plane. Anatase-type TiO₂ atoms are directly connected with Si atoms. Inconsiderable SiO₂ exists between anatase-type TiO₂ and crystalline silicon substrate. These interfaces could promote the transfer rate of carriers and decrease the recombination rate of hole–electron pairs. This evidence is confirmed by comparison with rutile-type TiO₂, which could not be grown on Si substrate due to the mismatching crystal lattice parameter. The rutile-type TiO₂ can be removed easily in ultrasonic condition.

Keywords: heterogeneous interface; crystal type and lattice matching; crystal induced; nanoepitaxial growth

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