Epitaxy

Epitaxy refers to the method of depositing a monocrystalline film on a monocrystalline substrate. The deposited film is denoted as epitaxial film or epitaxial layer. The term epitaxy comes from the Greek roots epi, meaning “above”, and taxis, meaning “in ordered manner”. It can be translated “to arrange upon”.

Epitaxial films may be grown from gaseous or liquid precursors. Because the substrate acts as a seed crystal, the deposited film takes on a lattice structure and orientation identical to those of the substrate. This is different from other thin-film deposition methods which deposit polycrystalline or amorphous films, even on single-crystal substrates. If a film is deposited on a substrate of the same composition, the process is called homoepitaxy; otherwise it is called heteroepitaxy.

Homoepitaxy

Homoepitaxy is a kind of epitaxy performed with only one material. In homoepitaxy, a crystalline film is grown on a substrate or film of the same material. This technology is used to grow a film which is more pure than the substrate and to fabricate layers having different doping levels. In academic literature, homoepitaxy is often abbreviated to “homoepi”.

Heteroepitaxy

Heteroepitaxy is a kind of epitaxy performed with materials that are different from each other. In heteroepitaxy, a crystalline film grows on a crystalline substrate or film of a different material. This technology is often used to grow crystalline films of materials for which single crystals cannot otherwise be obtained and to fabricate integrated crystalline layers of different materials. Examples include gallium nitride (GaN) on sapphire or aluminium gallium indium phosphide (AlGaInP) on gallium arsenide (GaAs).

Heterotopotaxy

Heterotopotaxy is a process similar to heteroepitaxy except for the fact that thin film growth is not limited to two dimensional growth. Here the substrate is similar only in structure to the thin film material.

Epitaxy is used in silicon-based manufacturing processes for BJTs and modern CMOS, but it is particularly important for compound semiconductors such as gallium arsenide. Manufacturing issues include control of the amount and uniformity of the deposition's resistivity and thickness, the cleanliness and purity of the surface and the chamber atmosphere, the prevention of the typically much more highly doped substrate wafer's diffusion of dopant to the new layers, imperfections of the growth process, and protecting the surfaces during the manufacture and handling.

참고

- 위키피디아