

### Silicon nanoparticles formed by thermal decomposition

이교열\*, 이주현, 김주형, 이은혜, 김미영, 강운호  
삼성종합기술원 MD LAB  
(kyoyeol@sait.samsung.co.kr\*)

Silicon nanoparticles for microelectronic and photonic applications have received an increasing interest. Their unique physical properties including quantum confinement effect and coulomb blockade phenomena make Si-QDs suitable for use in new silicon-based devices, such as single electron transistor (SET) and nanocrystal floating gate memory. Among the various techniques for synthesizing Si nanoparticles, we used thermal decomposition of silane (SiH<sub>4</sub>) in a reactor to prepare high purity nanoparticles. The system is composed of two step furnace, pyrolysis and oxidation, and one deposition step. Particle size and distribution were measured using a differential mobility analyzer, scanning electron microscopy (SEM), and transmission electron microscopy (TEM). With the variation of silane concentration, pressure, and residence time of source gas in pyrolysis reactor, Si nanoparticles size and distribution varied. By controlling parameters, high densities of Si nanoparticles were successfully deposited on a wafer. We could control their size and geometric standard deviation in the range under 10nm and 1.4, respectively. SET and nanocrystal floating-gate field-effect transistor (FET) memory using Si nanoparticles were fabricated. We will discuss SET characteristics and memory effect in fabricated nanoparticle devices.