

Realization of vertical Ge/Si nanopillars by maskless etching of Ge quantum dot nanostructures

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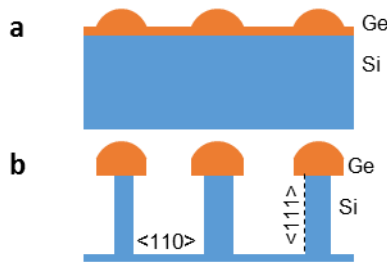


Figure 1: Schematic representation of the fabrication process: (a) Ge QDs are grown on (110) Si by Stranski-Krastanov growth mode; material around Ge QDs is removed by KOH etch.

Abstract: In this communication we report on the method to realize vertical Ge/Si nanopillars. The method consists of growing one layer of Ge quantum dot (QD) (Figure 1a) on Si substrate by gas-source molecular beam epitaxy ^[1] and consecutive anisotropic etching of material around QDs with KOH (Figure 1b). By growing the structures on (110)-oriented Si substrates, the etching profile is made vertical, since the stopping $\langle 111 \rangle$ planes for KOH etch are normal to the

surface. The resulting structures are mushroom-shaped with Si “stems” and Ge “caps”, as presented in Figure 2. The size of stems and caps can be controlled by adjusting Ge growth conditions and KOH etch duration.

Such structures reduce the surface reflectivity and broaden optical absorption spectrum. In addition, the shape of these nanostructures coupled with low emissivity and high reflectivity of Ge as compared to Si ^[2], may be used to realize heat diodes for thermal insulation of the surface. In our communication we will present results of the shape and density control and analysis of physical properties of these nanostructures

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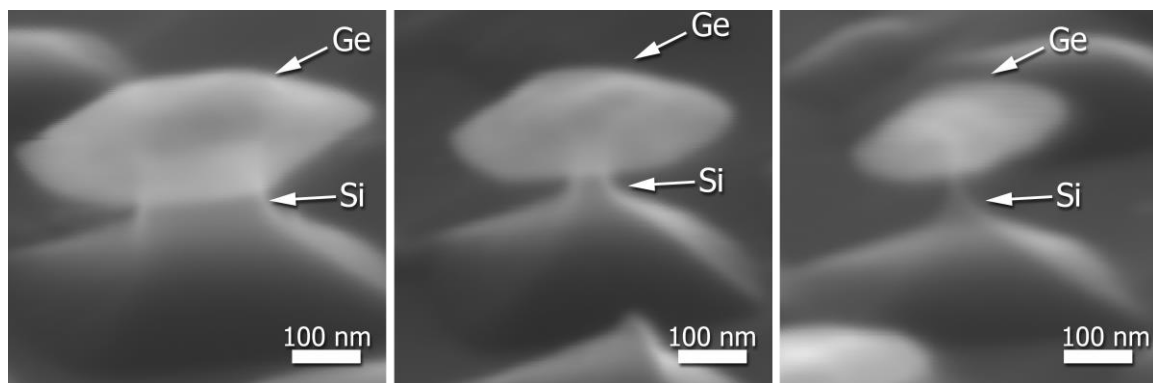


Figure 2: Mushroom-like nanostructures obtained by etching 1 layer of Ge QD on (110) Si.

References:

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