

PREFORMED METALLIC CLUSTERS AS CATALYSTS FOR Si NANOWIRES SYNTHESIS

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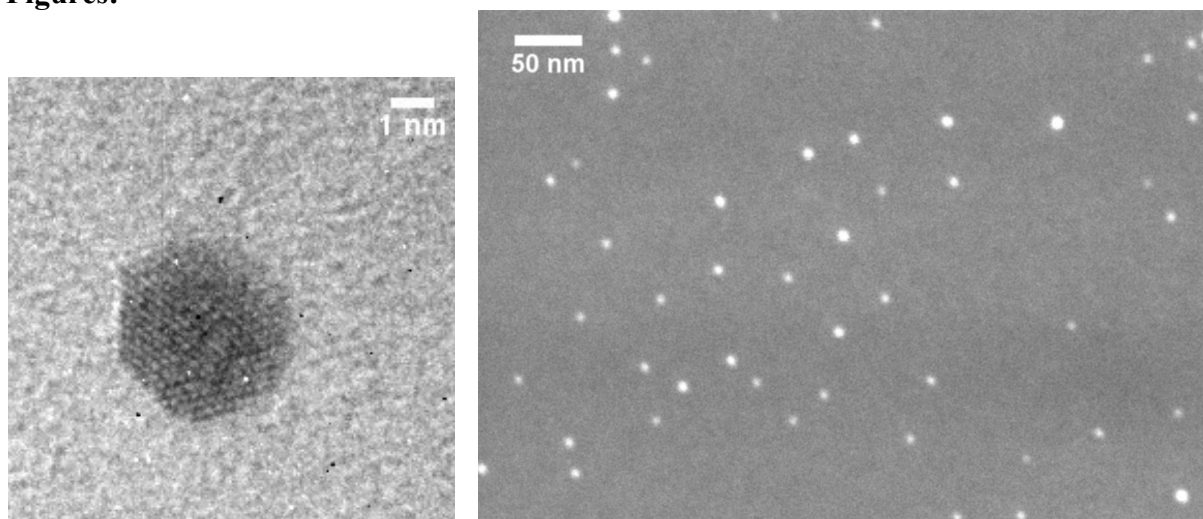
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Semiconductor nanowires, especially silicon nanowires (SiNWs), will certainly be used as essential building blocks in tomorrow nanoscale devices. Therefore, a lot of work has been devoted to find the best synthesis conditions for their efficient growth. In most of the synthesis, the metallic nanoparticles used as catalyst play a major role in the growth, controlling in particular the diameter of the SiNWs.

Usually, nano-droplets obtained by annealing a thin metal film, chemically synthesized metal colloids, or nanoparticles obtained *in situ* by laser ablation, are used as catalyst. However, the use of metal clusters synthesized by a physical mean appears as an interesting alternative to these methods. Indeed, it presents several advantages: the size and the density of the nanoparticles can be independently controlled; very small particles (a few nm) with a quite sharp size distribution can be produced; clusters of various elements can be synthesized; the particles are “clean” (no pollution, no surfactant); almost any substrate can be used; and it may be possible to organize the clusters on a substrate...

We show that preformed metallic clusters, synthesized in a sputtering gas-aggregation source, can actually be used as catalyst in conventional CVD growth of SiNWs, and we discuss the benefits of such an original approach. In particular, we have extensively studied gold clusters, determining their distribution on a substrate, together with its evolution with the temperature, their structure, and the impact on the nature of the SiNWs. We also discuss the possible use of other metals as efficient catalyst nanoparticles.

Figures:



Left: High resolution transmission electron microscopy image of a 4 nm diameter gold cluster. Right: Scanning electron microscopy image of gold clusters deposited on a silicon substrate, to be used for the CVD growth of SiNWs.