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**Deterministic Synthesis and assembly of Germanium Nanowires**

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— During the past decade, Ge has gained renewed interest due to its high carrier mobilities and small band gap, which is ideal especially for device scaling down to sub-100nm range. On the other hand, chemically derived low dimensional materials such as nanotubes and nanowires are attractive because of their easiness in produce, structure perfection and unique electronic properties. However, relatively few studies have been carried out on controlled synthesis of Ge nanowires (GeNWs). We demonstrate that controlled synthesis of high quality GeNWs can be performed at low temperatures below 300 ° C via a chemical vapor deposition reaction. 100% yield with regard to catalyst particles was obtained for the first time, and this growth technique can be extended to produce grams of GeNWs in a small reaction. Sizes of GeNWs are determined by catalyst particle sizes and length is determined by growth time. As-produced GeNWs were also shown to be excellent field effect transistor materials. In addition, various post-growth assembly methods were studied and aligned GeNWs with tunable density were obtained. This work provides insights in growth mechanisms of nanowires in general and it can be applied to produce large volume of single crystalline GeNWs.

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