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Au-Induced Assembly of Protective Carbon Shells on Ge Nanowires ELI SUTTER, PETER SUTTER, Brookhaven National Laboratory — Semiconductor nanowires (NWs) are promising materials for novel devices. Among them group IV semiconductors offer compatibility and facile integration with conventional electronic circuitry. Given the large surface-to-volume ratio of NWs, it is especially important that the NW surface be protected against oxidation to avoid uncontrolled property changes. For Ge NWs such oxidation protection is not provided by a stable native oxide (as is the case for Si). Hence, any Ge NW-based devices will require the development of passivation or encapsulation techniques. Here we discuss real-time observations by high-resolution transmission electron microscopy during annealing of individual carbon-supported Ge NWs [1]. At moderate temperatures (∼300C) even thick oxide layers on the Ge NWs are reduced rapidly. This is followed by the assembly of crystalline carbon shells that depends critically on traces of Au on the NW surface originating from the Au/Ge catalyst nanoparticles used for the NW synthesis. We demonstrate that the C-shells provide efficient protection of the Ge NW surface against oxidation in ambient air. More generally, our results point at using metal surface decoration to trigger the encapsulation of a wide variety of NW materials in protective C-shells.
[1] E. Sutter, P. Sutter, Adv. Mater. 18, 2583 (2006).

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