WURTZITE CADMIUM TELLURIDE NANOWIRES GROWN BY PULSED LASER DEPOSITION

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Deposition of ordered arrays of semiconductor nanowires on commercially available substrates is an area of great interest. One of the most promising methods to achieve such structures has been the production of nanowires derived from catalytically driven processes accessible through the formation of metal droplets on a substrate's surface. One material that has received little attention in this regard is the II-VI semiconductor Cadmium Telluride (CdTe). Presented here is a report describing the deposition CdTe nanowires on C-plane sapphire substrates.

Pulsed laser deposition was used to deposit the CdTe nanowires as well as the catalytic material. Nanowire formation falls within a relatively narrow window of processing parameters. Nevertheless, wires produced in this manner can show a high degree of size uniformity and a complete absence of the 2-dimensional background layer that often grows simultaneously in other semiconductor systems. Figure 1 shows a scanning electron microscope (SEM) image of the CdTe nanowires randomly distributed on the substrate's surface. Growth dynamics limit the wire height to approximately 350 nm. Images showing the top view (Figure 2) indicate that the nanowires are highly faceted with a hexagonal geometry. The orientational relationship between the faceting directions relative to the underlying substrate is identical for all nanowires; a clear indication of an epitaxial relationship between the wire and substrate. X-ray analysis indicates a strong wurtzite signature instead of the zincblende crystal structure normally associated with bulk CdTe. The analysis indicates that a small amount of the zincblende phase is present, but it is likely attributable to the small number of tetrahedron structures found on the surface (Figure 3).

Thus far, no attempts have been made to produce periodic arrays of these nanowires. An encouraging observation in this regard, however, is the existence of long lines (>100 um) of nanowires that are infrequently observed on the substrate's surface (Figure 4). These lines likely originate from the nucleation of nanowires at a structural defect in the substrate. Such a mechanism may facilitate the formation of CdTe arrays. Progress in this regard will also be reported.

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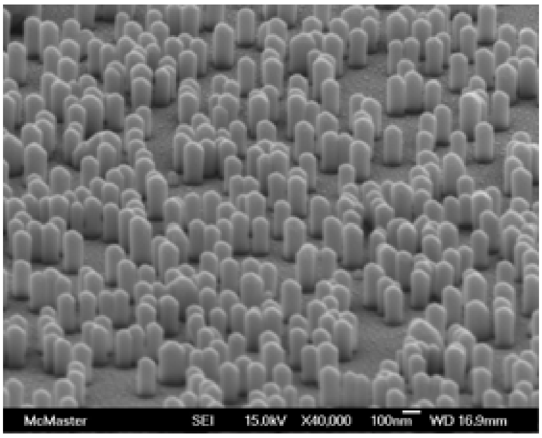

Figure 1

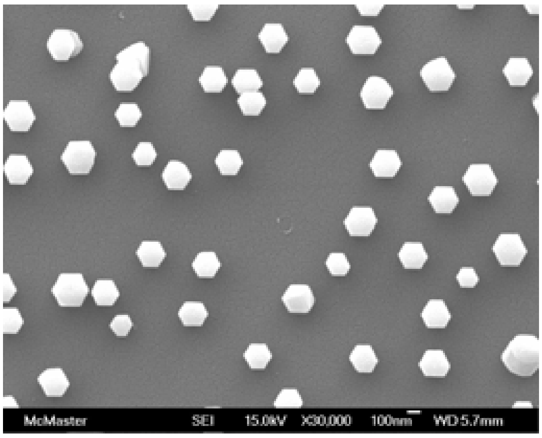

Figure 2

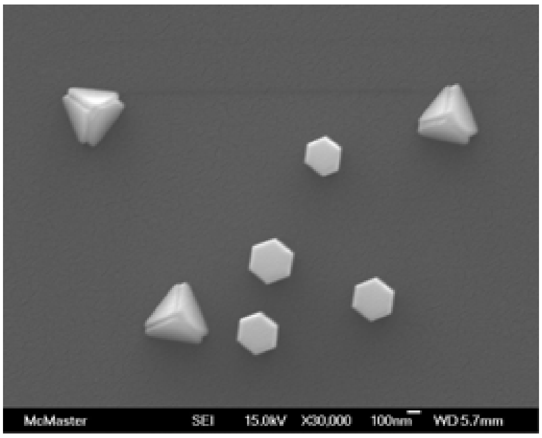

Figure 3

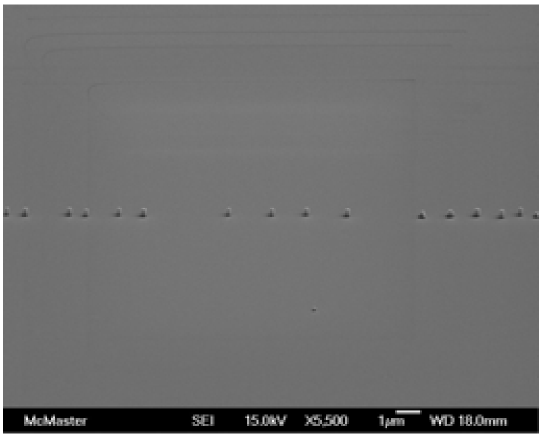

Figure 4

Figure Captions:

Figure 1: SEM image of CdTe nanowires deposited on a C-plane sapphire substrate.

Figure 2: SEM image showing the top view of CdTe nanowires deposited on a C-plane sapphire substrate.

Figure 3: SEM image showing the presence of both hexagonal and tetrahedral CdTe structures.

Figure 4: SEM image showing the nucleation of CdTe nanowires in a line that extends well over 100 um in length.