

## **46f Growth of Znse Nanowires by Metalorganic Chemical Vapor Deposition Using Nanostructured Metal Catalysts**

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One-dimensional nanostructures (wires, rods, belts and tubes) of II-VI compound semiconductors have become the focus of intensive research due to their distinct electronic, optical, and chemical properties that can enable a variety of applications in nanoelectronics, sensors, and photovoltaics.

We report the synthesis of ZnSe nanowires by metalorganic chemical vapor deposition (MOCVD) using nanostructured metals as growth initiators and catalysts. Typical metals employed in this study are Ag and Au. They have been used as initiators and catalysts for vapor-liquid-solid nanowire growth. The ZnSe nanowires were grown by reacting vapors of dimethylzinc with hydrogen selenide gas, both diluted in hydrogen, in a vertical MOCVD reactor equipped with a split inlet to minimize pre-reactions between the Zn and Se precursors. Typical substrates were Si wafers seeded with the metals, either in the form of colloidal particles or in the form of thin films that were sputtered and subsequently heated to above the melting point of the metal to create a fractal nanostructure on the surface of the substrate. The typical operating pressure of the reactor was 120 Torr and the typical growth time was 30 minutes. The susceptor temperatures used in this study ranged from 300 to 700 degrees C. The susceptor temperature is important for initiating and maintaining the nanowire growth and its manipulation is critical for optimizing the process.

The best quality ZnSe nanowires were grown using Au as initiator and catalyst. The nanowires were single crystalline with diameter controlled by the feature size of the seeds and length controlled by the growth time. The smallest diameter that could be achieved with this technique was around 20 nm and the typical length for 30 min growth was about 2 microns. The Ag seeds yielded nanowires that were polycrystalline and of inferior quality to those obtained using Au. Experiments aiming to grow ordered (parallel) ZnSe nanowire arrays are currently underway using Au nanodot arrays that are electrodeposited in the nanochannels of a hexagonal close-packed alumina template. The structural and morphological analysis of the nanowires was performed using high-resolution transmission electron microscopy (HR-TEM) and scanning electron microscopy (SEM). The optical properties of the materials are being studied by using absorption, photoluminescence, and Raman spectroscopy. The ultimate objective of our research is to achieve precise control over size, crystal structure, and growth orientation of the above nanomaterials to enable applications in nanoelectronics that exploit their unique properties.