486d Selective Growth of Zinc Oxide Nanowires Grown from Thin Film Multilayer Structure for Shadow Lithography

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High aspect ratio and rigid structure of oxide nanowires (NWs) make them useful for nanoscale circuits, interconnects, NEMs, and sensing. There are many literature examples of ZnO NWs being grown by Au as the catalyst. Critical to their application is the location and diameter control of these 1-D nanostructures. Our research focuses on the growth of ZnO NWs from an exposed edge of an Al2O3/Au (10-30 nm)/Al2O3 thin film multilayer structure patterned on a silicon substrate. The Au film acts as a catalyst for ZnO NWs in a VLS growth process and also confines the NW growth area. Such thin film patterning eliminates the necessity for e-beam lithography as the film thickness determines nm-scale line dimension. The growth is performed at 700o C in a high temperature furnace with an Ar flow of 250-300 sccm and O2 flow of 5-10 sccm. The vapor pressure of the Zinc source is controlled by the flow of gases and the source temperature. ZnO NWs were observed to grow from the cleaved/etched face of the multilayer structure in the selective area via VLS growth process. The NWs exhibited diameters between 40 to 50 nm and an aspect ratio over 10. The NWs were characterized by SEM, TEM and EDS studies. The diameter of ZnO nanowires can be adjusted by changing the thickness of Au thin film. Such an approach to control nanowire diameter and its selective growth can be the basis for the development of bottom-up growth of architectures and cast nm-scale lines in a shadow lithography process.