Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Fabrication of single-crystal Si nanowires by ultrahigh vacuum magnetron sputtering. J. W. KNEPPER, X. W. ZHAO, F. Y. YANG, The Ohio State University — Semiconductor nanowires have attracted great interests due to the intriguing fundamental science and technological application they provide. Many semiconductor materials have been made into single crystal nanowires with superior crystal quality and high mobility. Among them, silicon is particularly interesting because silicon is the foundation of modern electronic technology. A majority of the nanowire synthesis used laser-assisted catalyst growth or chemical vapor deposition. Here we reported a different approach to the fabrication of semiconductor nanowires using ultrahigh vacuum magnetron sputtering. Using thin Au layers as catalyst via vopor-liquid-solid mechanism, single crystal Si nanowires have been grown on Si substrates at a temperature of $\sim$700 $^\circ$C. Electron microscopy revealed that most Si nanowires grew epitaxially on Si(111) surfaces. Si nanowires are perpendicular to the Si(111) surface with a Si/Au alloy sphere on the top of the nanowires. The growth of Si nanowires on Si wafers with other orientations and amorphous silicon oxide layers was also observed, but with much less probability. The diameter of the Si nanowires is about 200 nm using Au layers as catalyst. The nanowire diameter can be controlled to smaller size by patterning the Au layers into small dots to reduce the catalyst size. Si nanowires fabricated by ultrahigh vacuum sputter at a base pressure of 10ˆ-10 torr are high purity and can be easily doped to desirable carrier concentration.

J. W. Knepper

Date submitted: 29 Nov 2005 Electronic form version 1.4