Fabrication of Nanoscale Columnar Diodes by Glancing Angle Deposition

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Abstract

Glancing angle deposition (GLAD) is a process in which thin films are deposited onto a substrate with obliquely incident vapor together with precisely controlled azimuthal substrate rotation. Ballistic shadowing effects due to the oblique incidence produce nanoscale structures, and a variety of morphologies, including tilted columns, helices, chevrons, and vertical columns can be achieved. Due to this control of morphology and the compatibility of the process with a wide variety of materials, GLAD films have found applications in fields such as sensing, photonics, photovoltaics, and catalysis, where they are predominantly used as coatings with tunable optical, mechanical, and chemical properties. However, there has been little work regarding its use for the fabrication of electronic devices. GLAD films are promising in this respect because it would be a step toward fabrication of nanoscale integrated devices without lithography. We propose a method for fabricating vertically-aligned, columnar Schottky diodes by GLAD. We then fabricate such a device using electron beam evaporation of chromium onto a silicon substrate, with chromium and aluminum contacts, and characterize these devices by SEM and I-V curve measurements and compare them to planar diodes of the same materials.

Biography of Presenter

Jacob Weightman is an undergraduate student at Macalester College, where he is pursuing a double major in physics and computer science. He did a research project last summer on ultrafast time-resolved terahertz spectroscopy measurements of solution-processed perovskites for photovoltaics at Macalester College with Dr. James Heyman. He has also worked on the construction of a photoluminescence spectrometer for characterization of GaN.