Abstract: My research group has worked on epitaxial growth of high-quality germanium on silicon for a variety of advanced applications, including virtual substrates for integrating III-V multijunction solar cells, high-mobility transistors, and quantum computers. In this presentation, I will discuss the importance of understanding (1) the surface physics of growth precursors on silicon vs. on masking template for selective epitaxial growth and (2) the impact of templates on crystalline defects, film stress, and material quality. In a particular case of uniformly applied 2D array of compressive stress, I will further describe how such stress field can cause compositional variation in silicon-germanium alloys to form germanium quantum dots without needing additional Stranski-Krastanov-type growth. As an ultimate test of our cumulative understanding, we have successfully integrated III-V films on silicon for photovoltaic applications, and fabricated and characterized high-mobility transistors on wafer-scale, engineered germanium-on-silicon substrates. I will present the details of our findings and their implications in creating unique engineering devices.

Biography:
Dr. Han is a Professor in the Departments of Chemical & Nuclear Engineering and Electrical & Computer Engineering at the University of New Mexico (UNM). He earned his Ph.D. in Chemical Engineering from the University of California at Santa Barbara and his B.S. in Chemical Engineering with Honors from the University of California at Berkeley. His current research topics include (1) thin film processing and nanoscale surface corrugation for enhanced light trapping for photovoltaic devices; (2) technology development for energy harvesting in urban areas; (3) metal matrix composite development for high-efficiency multijunction solar cells; (4) heteroepitaxial films on Si for photovoltaic, electronic, and sensor applications; and (5) hybrid micro/nanofluidic systems for advanced bioseparation and analysis. Dr. Han is a recipient of an STC.UNM Innovation Award consecutively from 2009 to 2015, a UNM Junior Faculty Research Excellence Award in 2005, and an NSF Career Award in 2001. Dr. Han has over 50 publications in peer-reviewed journals and over 160 invited/contributed papers at academic institutions and conferences; he has h-index of 21 and i10-index of 33.