Project Title: "RUI: Improved Thermal Stability of Metal Contacts and Diffusion Barriers to SiC and AlxGa1-xN using Refractory Metal Borides" # ECCS 0622086

The objective of this research is to develop thermally stable ohmic and Schottky contacts to SiC and $Al_xGa_{1-x}N$ semiconductors. These semiconductors are suitable for fabricating electronic devices for high temperature and high power operations, and therefore require metallizations that maintain stability under these conditions. The approach is to introduce selected refractory metal borides (ZrB_2, CrB_2, TiB_2, HfB_2 and W_2B_5) as ohmic and Schottky contacts and as diffusion barriers on these semiconductors. These will be fabricated by photolithography and sputter deposition, and characterized using various methods including current-voltage, capacitance-voltage, transmission electron microscopy and Rutherford backscattering spectrometry. The contacts will be annealed under various conditions and their electrical and microstructure evaluated in order to assess their thermal stability. Availability of thermally stable ohmic and Schottky contacts is a major hurdle in achieving high performance devices based on SiC and $Al_xGa_{1-x}N$ semiconductors. The properties of the selected borides strongly suggest they will be stable in high temperature and high power applications. The proposed research will advance the currently scanty knowledge base of the use of borides as contacts for SiC and $Al_xGa_{1-x}N$ through thorough investigation. The thermally stable metallizations developed in this research will be used in fabricating electronic devices with extended high temperature and high power operation limits. These in turn will enable huge energy savings, increased performance and reliability in the utility power, the aerospace, automobile and military applications. The proposed research will also help strengthen the research programs where undergraduate and graduate students are trained in semiconductor research.