

1. **Research Title:** Growth and Characterization of Carbon Nanostructures on SiC
  
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Solid State Physics , Materials Science and Electrical Engineering (MS or PhD level)
  
4. **Objectives:** Graphene and carbon nanotube (CNT) films are novel forms of carbon which have been shown to have interesting electrical, structural, and chemical properties. Growth of these materials can occur at high temperatures by the preferential sublimation of silicon from crystalline SiC. Dense, vertically aligned multiwalled CNT's result when SiC wafers are annealed in moderate to low vacuum at temperatures from 1200 to 1700°C. Exitaxial graphene forms under ultra high vacuum at temperatures around 1200°C. These films are being investigated for a variety of applications such as high performance transistors, field emission of electrons and chemical sensors. Very little has been reported to date on the physics and chemistry of the growth process. It is the objective of this project to explore the growth of either graphene or CNTs by modification of the SiC substrates prior to growth and in-situ to optimize the electronic properties of the carbon layers.
  
5. **Description:** The proposed project will investigate the interplay of the growth parameters with the electrical characteristics of the film. The growth parameter space to be studied consists of the growth temperature and ambient, and the modification of the SiC surface structure through various surface preparations. An Oxygen furnace capable of 1800°C and an EPI 930 Molecular Beam Epitaxy machine are available at AFRL/MLPS. Characterization of the resulting structures will be a strong component of this project and various electron microscopes and electrical characterization instruments are available. Raman spectroscopy and other optical studies are possible in collaboration with other groups. Novel characterization techniques and growth processes are encouraged.
  
6. **Research Classification/Restrictions:** Some of this work might be covered by ITAR restrictions.
  
7. **Interest in Summer USAFA Cadet:**  
Not interested in USAF Cadet in Summer of 2008 for this project
  
- Eligible Research Institutions:**

X Universities (DAGSI)	X AFIT
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