1. Research Title: Interfacial Cracking Solutions for High Temperature Power Electronics

2. Individual Sponsor:

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3. Academic Areas/Field and Education Level: Materials Science & Engineering, Physics, Chemistry, Macromolecular Science, Mechanical or Electrical Engineering - MS or PhD level

4. Objectives: This research task investigates improving performance and reliability of high temperature power electronics packaging. Specifically, interfacial cracking caused by thermal cycling limits electronics device life and capability. Carbon nanotechnology has the potential to improve thermal throughput as well as provide a compliant mating layer to mitigate the mechanical stresses that result from mismatched coefficients of thermal expansion.

5. Description: Two of the most pressing challenges to using CNTs as a thermal interface material (TIM) layer are: (1) large thermal contact resistances, and (2) weak interfacial adhesion. These are due to the low fraction of CNT-substrate contact and insufficient chemical bonding between the CNT and the substrate surface. In order to address these challenges, research is needed in the areas of CNT growth optimization, investigation of pre- and post-growth surface modification techniques, and the testing and characterization of the CNT thermal and mechanical properties.

6. Potential Commercial Impact and Industry Involvement:
High temperature and reliable components, such as silicon carbide switching devices, are in-demand for increasing overall aerospace system performance. Research derived from this work can be transitioned to one of our aerospace power electronics partners.

7. Research Classification/Restrictions: U.S. Citizens only.

8. Eligible Research Institutions:

[X] Universities (DAGSI) [X] AFIT [ ] USAFA