What does this group do?

- Attempt to solve materials problems using new carbon materials AND/OR Increase understanding of processing – properties – structure

- Strength – Weight?
  - Strength – Structure & processing

- Hot Spots?
  - Directional thermal conductivity

- Waste Heat Energy?
  - Thermoelectric coatings

What are carbon materials?

NOT CO₂.
Matter assembled from mostly carbon atoms: graphite, diamond, fullerenes & nanotubes

What are C materials used for?

- Carbon Fiber Composites
- Graphite Heat Spreaders / Shields
- Electrodes for making primary Al, melting steel & Energy Storage devices
- Thermal Interface Materials
- Thermoelectric devices
- Adsorbents (filtration/separation)
Ongoing projects: Carbon Fiber

50 wt.\% Carbon Fiber Composites

50\% of carbon fiber cost is precursor

Lightweight, Safe, Strong, Corrosion Resistant… but $$$$

117 MPGe
Ongoing projects: Carbon Nanotubes

- Thermal Interface Materials
- Thermoelectric devices
- “Fuzzy” fiber
What skills and expertise can you acquire?

- **Materials Engineering**
  - Fiber
    - Polymer processing
    - Heat treatment
    - Materials characterization
  - Nanotubes
    - Experimental design
    - Materials characterization
    - Thermal analyses

- **Chemistry**
  - Fiber
    - Composition
    - Conversion
    - Reactions
  - Nanotubes
    - Synthesis
    - Catalyst development
    - Doping development

- **Mechanical Engineering**
  - Fiber
    - Process design
    - Process control
    - Materials mechanics
  - Nanotubes
    - Thermal analyses
    - Equipment design
    - Experimental design

- **Chemical Engineering**
  - Fiber
    - Process design
    - Process control
    - Fluid dynamics
  - Nanotubes
    - Equipment design
    - Equipment modifications
    - Materials characterization
• Where does the carbon materials group get funding from?

U.S. Department of Defense  U.S. Department of Energy
KY Dept. of Energy Development & Independence  Industry Collaborations

• Where does the carbon materials group publish?

CARBON  Advanced Materials  J. Nanoscience and Nanotechnology
POLYMER  FIBERS  Composites Science & Technology

• Where does the carbon materials group present its results?

SAMPE: Society for the Advancement of Material and Process Engineering  CARBON conferences

• Where do students that work in the carbon materials group go afterwards?

Industry (e.g. Intel, Cummins, Cytec, Michelin, Bolt Threads)  Government (e.g. DoD, National Labs)
Graduate or Professional School  Academia (e.g. Univ. de Alicante)