

Advanced Magnetics for Power & Energy Development (AMPED)

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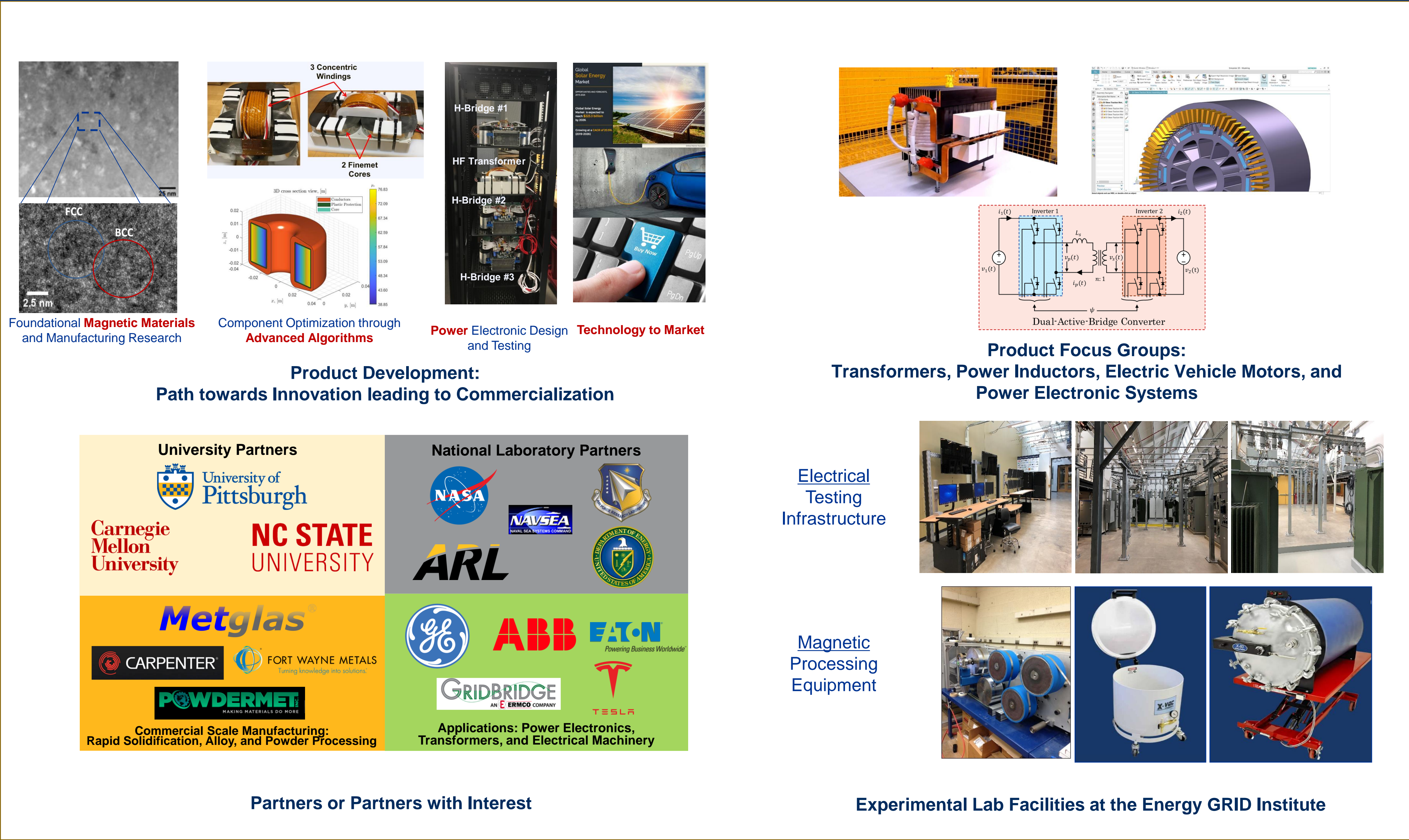
Motivation

- Trends towards electrification are driving the needs for improved **soft magnetic materials** that can operate at high frequency and power levels.
- This consortium will serve as a “one-stop shop” to meet the **power electronics community** needs by performing advanced R&D spanning from new material and manufacturing up through the applied electrical engineering application space (**inductors, motors, and transformers**), thereby training engineers with multidisciplinary skillsets in **materials science** and **electrical engineering** that are needed.

Project Description

- Swanson School of Engineering:** Broadly, faculty will develop an innovation ecosystem and educational programs (called AMPED) for advancing soft magnetic materials and electrical engineering technologies spanning fundamental science to end-use application in collaboration with various material suppliers, electrical manufacturers and government entities including the DoE, DoD, and NSF offices.
- School of Information and Computing:** Machine learning algorithms tailored for physics-based problems with modern parallel and distributed computing techniques are needed in the power magnetics space for speed, accuracy, and reproducibility of results.
- Katz School of Business:** Will provide its expertise to address the challenges of the technology-to-market progression in such areas as (a) user-focused technology and product development; (b) assessing financial implications, including return on investment; (c) assessing and addressing perceived risk with innovations; (d) entrepreneurial opportunities and market emergence; and (e) innovation strategy aimed at increasing both business and social value.

Establish a **multidisciplinary** world class center focused on **advanced magnetics** for **electric power engineering** applications with **industry** and **government** partners.



Context and Potential Impact

- Challenge:** Current magnetic materials have limitations in terms of their (1) manufacturability at scale, (2) losses at elevated switching frequencies, (3) saturation induction, and (4) tailorable magnetic properties resulting in a limitation to leverage benefits from state-of-the-art power semiconductor devices that switch at kHz to MHz operation.
- Widespread Available Talent:** Since 2011, regionally centered efforts within the Greater Pittsburgh area (specifically personnel at CMU and at Pitt) coupled with strategic national partnerships with the FREEDM and Power America Center at NCSU have spearheaded the way in researching novel magnetic materials and optimized devices for large-scale power magnetics applications.
- Consortium for Talent Growth:** These historic efforts, established relationships, and sampling of company pursuits in power magnetics provide the foundation for a regional university-based consortium model with a national network of partnerships and a primary goal of addressing workforce challenges while also promoting research, development, and commercialization of new technologies at full-scale in collaboration with lab and industry partners.

Project Deliverables

- Faculty members establish roadmap of multidisciplinary research ideas and sources of funding. DoD is a top priority followed by DoE (Advanced Manufacturing Office and Vehicle Technology Office), and the NSF.
- Faculty members support existing graduate students (Swanson) or hire summer support (Katz and SCI independent study graduate student stipends) to begin investigating collaborative R&D (Katz and SCI) in optimization methods and applications, and exploring barriers to market penetration (Katz) for power magnetic applications.
- Swanson faculty are building out the laboratory space and applying for equipment grants.
- Faculty members host technical meeting between current industry members of AMPED and new invitees of AMPED. Faculty from Katz and SCI are introduced to the engineering community. Event is held at the Energy Innovation Center. Equipment is purchased and installed to show physical laboratory presence to AMPED community.

Acknowledgements

- Thanks to all of the material providers, manufacturers, and government agencies supporting AMPED found at <https://pittamped.github.io/>

