Realizing the Feasibility of Using Multifunctional Materials in Transportation Infrastructures

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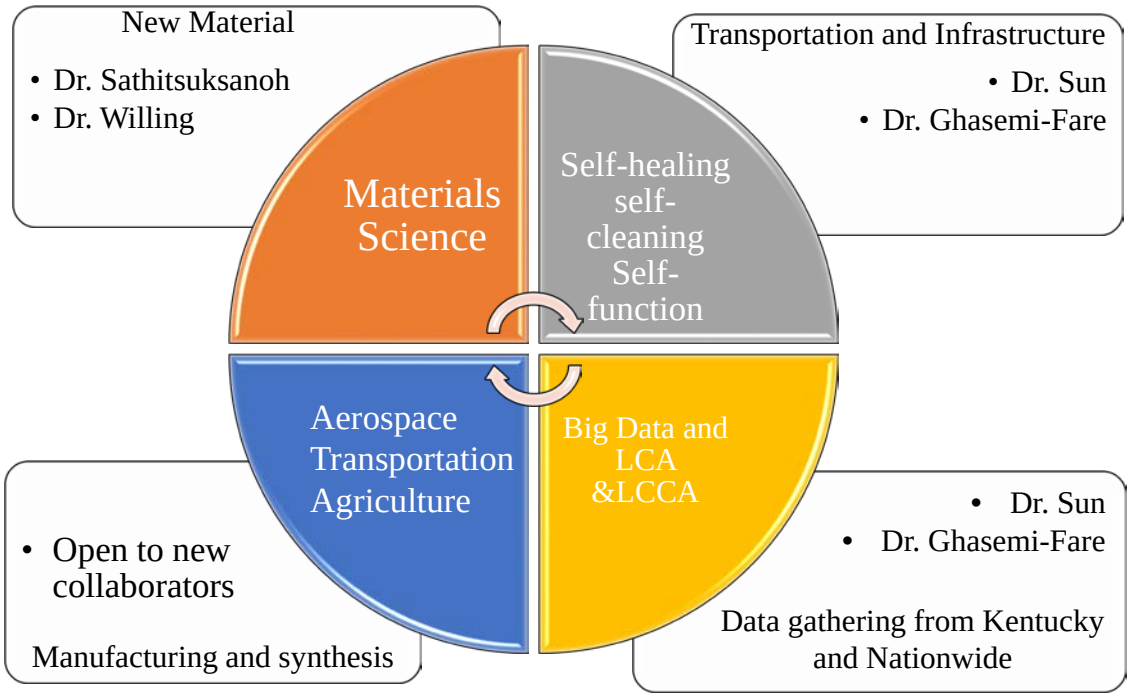
The overall objective of this proposed project is to develop new multifunctional materials for transportation. It is envisioned that the developed technology will provide a number of benefits for the state of Kentucky including: (1) generating new knowledge, (2) training the new workforce for industries, and (3) creating manufacturing jobs. Current materials development relies on scientific values; however, their socio-economic impacts are often ignored. To comprehensively include the efforts and benefits of the newly synthesized materials the life cycle cost analysis (LCCA) needs to be performed. LCCA will determine the advantages of using these multi-functional materials compared to maintenance costs of infrastructures using existing materials.

The project will potentially create new revenue streams for construction companies, agriculture and aerospace sectors in the state of Kentucky from use of multifunctional materials. The proposed project can also train the workforce with the cutting-edge skills, and promote STEM education. The newly developed innovative self-healing, self-cleaning, and self-function materials will lead to future durable and intelligent civil and building structural applications and especially cater for the stringent requirements on more durable and resilient concrete materials and infrastructures in national strategic development plan.

Fundamental investigation of the relationship between materials' synthesis-structure-function-impact will aid in designing these multifunctional materials. The new multifunctional materials will be cheap, locally sourced, and easily recycled. The use of these materials in infrastructures is expected to save energy, cost and increase the service life of the infrastructures.

Our *long-term goal* is to enhance the state of Kentucky's economy and promote STEM education. Five research tasks are defined to achieve this long-term goal: (1) Synthesis of new materials, (2) Evaluation of the properties and performance of the new materials in the lab, (3) Model performance to study the long term response of the infrastructures using the updated properties, (4) Analyzing the application of the materials in the field, and (5) LCCA analysis and comparison of the multi-functional materials with the current technology. For completing all the aforementioned research tasks, scientists and researchers with different backgrounds from all over the Kentucky needs to be participated. It is envisioned that the developed technology can be applied to other sectors including agriculture, aerospace, and health.

Our team is particularly *well prepared* to undertake the proposed project because the research team consists of researchers who have extensive experiences in materials development, transportation infrastructures and modeling performance.



Multi disciplinary project

- ✓ Includes different disciplines
- ✓ Open to any schools in Kentucky
- ✓ Includes STEM and K-12 students

Benefits for Kentucky

- ✓ Contribute in transportation and health
- ✓ Demand for new infrastructures
- ✓ Save time, energy and cost

Overall Goal of the project

- ✓ Self-healing
- ✓ Self-cleaning
- ✓ Self-function materials
- ✓ Performance modeling
- ✓ Data gathering from KY and all the states nationwide
- ✓ LCA analysis