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10/3/14



## MTSU Clean Energy Initiative Project Funding Request

There are five (5) sections of the request to complete before submitting. See <http://www.mtsu.edu/sga/cleanenergy.shtml> for funding guidelines. Save completed form and email to [cee@mtsu.edu](mailto:cee@mtsu.edu) or mail to MTSU Box 57.

1. General Information	
Name of Person Submitting Request Dr. Keying Ding	
Department/Office Chemistry	Phone # (Office)615-898-2475
MTSU Box # 68	Phone # (Cell) 615-961-4048
E-mail Keying.Ding@mtsu.edu	Submittal Date 10/2/14

2. Project Categories (Select One)	
Select the category that best describes the project.	
<input type="checkbox"/> Energy Conservation/Efficiency	<input checked="" type="checkbox"/> Sustainable Design
<input type="checkbox"/> Alternative Fuels	<input checked="" type="checkbox"/> Other -Education
<input type="checkbox"/> Renewable Energy	

3. Project Information
<p>a. Please provide a brief descriptive title for the project.</p> <p>b. The project cost estimate is the expected cost of the project to be considered by the committee for approval, which may differ from the total project cost in the case of matching funding opportunities. <b>Any funding request is a 'not-to-exceed' amount. Any proposed expenditure above the requested amount will require a resubmission.</b></p> <p>c. List the source of project cost estimates.</p> <p>d. Provide a brief explanation in response to question regarding previous funding.</p>
3a. Project Title- Part of 'Bring Green Chemistry to MTSU' Program
3b. Project Cost Estimate- \$2100 in total (part a: \$1950, Part b: \$150)
3c. Source of Estimate- a) Sigma-Aldrich; b) samples and poster printing costs
3d. If previous funding from this source was awarded, explain how this request differs? The proposed project includes a new research direction and a new activity to disseminate green chemistry within MTSU. (also see 4b)

#### 4. Project Description

(Completed in as much detail as possible.)

- a. The scope of the work to be accomplished is a detailed description of project activities.
- b. The benefit statement describes the advantages of the project as relates to the selected project category.
- c. The location of the project includes the name of the building, department, and/or specific location of where the project will be conducted on campus.
- d. List any departments you anticipate to be involved. Were any departments consulted in preparation of this request? Who? A listing may be attached to this form when submitted.
- e. Provide specific information on anticipated student involvement or benefit.
- f. Provide information for anticipated future operating and/or maintenance requirements occurring as a result of the proposed project.
- g. Provide any additional comments or information that may be pertinent to approval of the project funding request.

#### 4a. Scope: Work to be accomplished

This proposed project contains two parts.

Part a: Amides, amines and imines are a very important class of compounds that have been widely utilized in chemistry and biology as additives, dyes, and agrochemicals, etc. Traditional synthesis strategies require hazardous reagents and produce large amount of by-products at the same time. Thus, "greener" and more atom efficient processes generate major interest in both academia and industry. As the rapid growth of organometallic chemistry, transition metal catalyzed conversion to amides has made significant progresses and has shown great promise. This transformation is an efficient and atom-economical route with hydrogen and/or water as the only by-products and alcohol is a renewable bio-derived feedstock. However, one factor that has limited the current research is the catalysts used in the reaction are mostly based on precious metals, especially Ru, Rh, Os and Ir, which are expensive, rare, non-recyclable and posing energy and environment concerns. Two approaches are proposed by the PI. One way is to design non-precious metal catalysts (NSF grant pending). An alternate strategy is to develop recyclable heterogeneous catalysts. Graphene, with its unique electronic properties and large specific surface area, has stimulated many researches on immobilized catalyst systems. Immobilization of a catalyst on graphene may increase the catalyst's stability, performance and make the catalyst easy recyclable. In this project, PI will adopt well developed synthetic routes preparing graphene, reduced graphene and use novel synthetic methods for catalyst immobilization on graphene. We will investigate the catalytic performance of immobilized catalysts based on some well-known homogeneous catalysts in the literature. The PI will also explore the effects of different ways of immobilization on catalyst efficiency. Structures and compositions of the immobilized catalysts will be evaluated by SEM, TEM, XRD and XPS. Products will be analyzed by GC-MS and NMR.

Part b: Biodegradable materials from biomass feedstock is getting more attentions due to the increasing energy and environmental concerns. In many US universities' food courts, biodegradable PLA made forks and knives are already provided. However, MTSU still uses traditional non-degradable petroleum based plastic

tablewares, which is not sustainable in the long run. The PI propose an activity aiming to disseminate green chemistry and promote sustainable tablewares by organizing 2-3 students and making a poster presentation with demonstrations on biodegradable polymers at the Student Union. Hopefully, through our efforts, MTSU might eventually consider replacing original plastic forks and knives with those made from biomass feedstock and greener biodegradable PLA at Student Union. This task seems trivial but will provide a big benefit to the whole society in the future.

#### 4b. Scope: Benefit Statement

In fall 2013, the PI proposed a "Bring Green Chemistry to MTSU" program that includes activities of research, education, collaboration and public outreach, aiming to develop new sustainable technology and educate the next generation of researchers within the MTSU community. Past year's activities include:

1. A new "Green Chemistry" course is under design, expected to be offered in 2015.
2. A research on sustainable biomass conversion by earth-abundant metal catalyst is ongoing. We have successfully synthesized the first NiPd-rGo composite ready for further characterization and catalytic performance test for cinnamaldehyde dehydrogenation and other reactions. (Supported by Clean Energy program)
3. A well-known green chemistry scientist is invited to MTSU delivering a seminar on sustainable polymers.

The proposed project includes two of the activities for this coming year. For part a, the research results will serve as preliminary data for major external funding application for NSF Catalysis and Biocatalysis program. Through part b, the PI is expected to disseminate green chemistry in MTSU and get more and more students involved and learn the importance of green chemistry to our daily lives. The PI hopes that through the efforts, MTSU could eventually consider replacing non-degradable petroleum based plastic forks and knives with those made by biomass feedstock and greener biodegradable PLA at Student Union. This task seems trivial but will provide a big benefit to the whole society in the future.

The proposed project will greatly contribute to "Bring Green Chemistry to MTSU" program that will ultimately benefit our MTSU community.

### **4. Project Description (continued)**

#### 4c. Location of Project (Building, etc.)

Science Building (part a) and Student Union (part b)

#### 4d. Participants and Roles

part a,

Dr. Keying Ding (PI) - conduct experiments; supervise students

Three graduate students - conduct experiments

One undergraduate student - assist in lab, conduct experiments

This project is supported by Department of Chemistry. Graduate students are supported by fellowships.

part b,

Dr. Keying Ding - organizer and faculty advisor

2-3 undergraduate and graduate students - poster presentation, demonstration, etc.

#### 4e. Student participation and/or student benefit

Through this project, students will not only learn basic concepts of green and sustainable chemistry but also get hands-on research experiences in this field. We hope that through our proposed "Bring Green Chemistry to MTSU" program, more MTSU students will get involved and learn green chemistry. Most significantly, through this project, students can learn how green chemistry is so important and promising today and get interested in green chemistry, which will ultimately benefit our MTSU community.

#### 4f. Future Operating and/or Maintenance Requirements

see 4a and 4b

#### 4g. Additional Comments or Information Pertinent to the Proposed Project

Results from project (a) will serve as preliminary data for major external funding applications(NSF Catalysis and Biocatalysis Program); as for project (b), the PI hopes that through our efforts, MTSU could eventually consider replacing non-degradable petroleum based plastic forks and knives with those made from biomass feedstock and greener biodegradable PLA at Student Union.

**5. Project Performance Information**

Provide information if applicable.

- a. Provide information on estimated annual energy savings stated in units such as kW, kWh, Btu, gallons, etc.
- b. Provide information on estimated annual energy cost savings in monetary terms.
- c. Provide information on any annual operating or other cost savings in monetary terms. Be specific.
- d. Provide information about any matching or supplementary funding opportunities that are available. Identify all sources and explain.

5a. Estimated Annual Energy Savings (Estimated in kW, kWh, Btu, etc.) N/A

5b. Annual Energy COST Savings (\$)N/A

5c. Annual Operating or Other Cost Savings. Specify. (\$)N/A

5d. Matching or Supplementary Funding (Identify and Explain) N/A