

**CEGRA**



Tennessee  
Technological  
University

# Graduate Student Handbook



DEPARTMENT OF CHEMICAL ENGINEERING

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# PRINTING AND BINDING YOUR THESIS OR DISSERTATION

*As of Fall 2009, the graduate school at Tennessee Tech has implemented the "Electronic Thesis and Dissertation Initiative (eTD)." This allows graduate students to submit their theses/dissertations to the graduate school electronically in the form of a PDF document that can be accessed online.*

## PRINTING AND BINDING USING ETD:

**The process for submitting theses and dissertations through eTD is as follows ([www.tntech.edu/graduatestudies](http://www.tntech.edu/graduatestudies)):**

- *Convert document to a .PDF file (other file types for multi-media are submitted as supplementary files).*
- *Go to submission website at <http://www.etdadmin.com/tntech/> and create an account. The system generates a password, which will be sent to you to confirm the email address.*
- *Log-in and begin the submission process:*
- *Select publishing option. Read and accept the publishing agreement.*
- *Enter contact information (present and future, if known).*
- *Enter details of the submission (e.g., degree to be conferred, subject).*
- *Upload the PDF document.*
- *Upload supplementary files, if any.*
- *Choose other available options (e.g., copyright filing, ordering print copies, etc.).*
- *Complete any associated surveys (e.g., eventually the SED).*

- *Elect payment method (unless the school uses another process). Students may now pay publishing fees with a credit card at this point.*
- *Submit. Review confirmation screen, correct any errors, and finalize.*
- *The student will receive an email confirming that the Graduate School has received the submission.*
- *Correspondence will follow between the student and the Graduate School.*

**THROUGH THE ETD, COPIES OF YOUR THESIS OR DISSERTATION CAN BE PRINTED AND BOUND BY THE GRADUATE SCHOOL (BULLET 6 NUMBER 3, ABOVE). HOWEVER, IF YOU WANT TO PRINT COPIES OF YOUR THESIS OR DISSERTATION YOURSELF, THE GRADUATE SCHOOL CAN BIND THEM FOR A MUCH LOWER PRICE (\$10.00 PER COPY). FOLLOW INSTRUCTIONS BELOW.**

## PRINTING AND BINDING NOT USING ETD:

**Complete all of the submission instructions above, until bullet 6, then continue with the instructions below:**

### **FOR A MASTER'S THESIS:**

- *2 official copies must be submitted to the Graduate School by the date published in the Bulletin -these will be placed in the TTU Library.*
- *1 additional official copy is required to be submitted to the Department of Chemical Engineering*
- *You can also make additional copies for yourself/advisor/others.*
- *These cost \$10/copy to bind*

## **FOR A DISSERTATION:**

- *3 official copies must be submitted to the Graduate School by the date published in the Bulletin -these will be placed in the TTU Library.*
- *1 additional official copy is required to be submitted to the Department of Chemical Engineering*
- *You can also make additional copies for yourself/advisor/others.*
- *These cost \$10/copy to bind*

## **UNDER NO CIRCUMSTANCES SHOULD YOU GENERATE THE TWO FINAL COPIES FROM A PRINTER.**

YOU MUST PHOTOCOPY THEM FROM THE MANUSCRIPT MASTER ONTO 25 PERCENT COTTON CONTENT, 20 POUND PAPER. THE SURFACE OF COTTON PAPER IS SUCH THAT INK FROM NONIMPACT PRINTERS DOES NOT ALWAYS ADHERE PERMANENTLY.

## **COPY SHOPS IN COOKEVILLE:**

You will find area copy shops that are familiar with the University's requirements concerning paper and copy quality. The cost of having copies made by local shops is reasonable, and you will save little money by buying your paper and doing your own copying. Professional shops are responsible for equipment malfunctions and should maintain a supply of 25 percent cotton paper.

## **YOU MUST FILL OUT THE FORM BELOW AND SUBMIT IT TO THE GRADUATE SCHOOL TO GET COPIES OF YOUR THESIS/DISSERTATION BOUND**

THESIS/DISSERTATION BINDING ORDER FORM

NAME \_\_\_\_\_ Social Security No: \_\_\_\_\_  
Last, First, Middle

\_\_\_\_\_ Date Final Copies Submitted: \_\_\_\_\_  
Signature

Number of Final Copies Submitted: \_\_\_\_\_

COSTS:

**Binding Fee: \$10.00/copy**  
**Postage to US address: \$5.00/copy**  
(sent Book Rate)  
**Postage to overseas address: \$6.00/copy**  
(sent Surface Mail)

Copies @ \$10.00/copy = \$ _____	
Amount of Postage Paid \$ _____	
<b>TOTAL PAID</b>	<b>\$ _____</b>
<b>RECEIPT NO.</b>	_____

Please indicate below the accurate names and addresses of those persons, including yourself, to whom the remaining copies should be sent. If any copies are to be mailed off campus, you will need to include postage in the total amount paid.

Copy Number 1:

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# COMPUTER-AIDED ENGINEERING NETWORK

For students pursuing theoretical or modeling research, the computer-aided engineering (CAE) lab on campus at TTU is a valuable resource. It is managed by the Center for Manufacturing Research, and provides accounts for all engineering graduate students. For more information about all the available features, visit their web page:

<http://www.cae.tntech.edu/>

## HIGHLIGHTS OF THE CAE FACILITIES AND SERVICES:

Back-up storage for large and/or important files.

<http://www.cae.tntech.edu/help/file-server>

Setup a public web page to provide easy access for data or other research related information to your thesis committee or other co-workers.

<http://www.cae.tntech.edu/help/accounts/index.html>

Run computationally-intensive program somewhere other than your office PC or another campus lab.

<http://www.cae.tntech.edu/help/parallel>

To fully utilize the computational resources of the CAE lab, general knowledge about using Unix/Linux required. The working environment is command-line oriented, and does not utilize the familiar windows atmosphere. For beginners, there are a number of tutorials available to learn the basics:

<http://www.ee.surrey.ac.uk/Teaching/Unix/>

<http://hven.swarthmore.edu/~burns/unix.html>

[http://fsl.fmrib.ox.ac.uk/fs/course/unix\\_intro/](http://fsl.fmrib.ox.ac.uk/fs/course/unix_intro/)

*The benefit for using the CAE lab computers is that you can allow programs to run for days if necessary, or run multiple codes simultaneously. You don't even have to be on campus to check the status of your program, or to start new ones. Remote access is available to the CAE lab via a program called Putty:*

<http://www.cae.tntech.edu/help/remote-access/windows-putty/>

## THESIS TEMPLATES/GUIDELINES

The university offers a manual of guidelines to be followed in order to present a thesis for graduation. These guidelines are available in an easy access pdf or html environment and can be found at <http://www.tntech.edu/graduatestudies/thesis/default.asp> .

## NATIONAL AICHE AND KNOVEL LIBRARY

The primary governing body for chemical engineers in the US is the National American Institute of Chemical Engineers (AIChE) ([www.aiche.org](http://www.aiche.org)) . Currently, the organization has more than 40000 members. As a member, you will receive a number of special offers

including Webinars and access to a number of online publications via the Knovel Library (<http://www.aiche.org/Publications/Knovel/index.aspx>) as well as other discounts and benefits. Additionally, there are more specific societies within AIChE for individual subject areas which can be accessed from the site. Finally, as a member, you receive information about upcoming conferences and issues within the profession.

## PRINTING POSTERS:

One of the main ways to present your research will be in poster format. The university offers a few different methods by which you can print a poster. The main offices are the TTU water center, the computer help desk on the second floor of Clement Hall, and through the manufacturing center in Brown Hall. The office that you select will likely depend upon your funding source, so you should speak with your advisor prior to getting your poster printed.

# COOPERATIVE EDUCATION

## WHAT IS CO-OP?

It's a voluntary, independent education program available for all undergraduate and graduate students in any academic area. Work experience is gained with an employer who offers learning opportunities related to a student's academic discipline. The USCIS definition of a full time co-op is working more than 20 hours (approximately 40 hours) per week. Part-time co-op must be at least 10 hours and no more than 20 hours per week.

## WHO IS ELIGIBLE TO PARTICIPATE IN THE CO-OP PROGRAM?

Students must meet the following requirements:

Minimum **2.5 GPA** (GPA must be maintained while participating in the program)

Full-time student status

Must complete one semester at TTU prior to completing a co-op application

Transfer students from another college or university must complete two full semesters at TTU prior to completing a co-op application

## CO-OP PLANS.

THERE ARE THREE CO-OP SCHEDULING PLANS AVAILABLE:

- *Plan A - the student works full-time for an employer for 12 months.*
- *Plan B - the student works alternate semesters at the employer's site (work, return to school, work, etc.)*

- *Plan C - The student will attend college and work approximately 20 hours per week for the employer.*
- **STUDENTS PARTICIPATING IN THE CO-OP PROGRAM MUST REGISTER AND ENROLL IN ONE CREDIT HOUR FOR EACH SEMESTER OF THEIR ASSIGNMENT. THIS DOES NOT COUNT TOWARD GRADUATION REQUIREMENTS, HOWEVER, IT APPEARS ON THE TRANSCRIPT.**

## FOR INTERNATIONALS:

- *Students can participate in co-op after completing 2 full time semesters of study (excluding summer) in the U. S.*
- *International students can participate in the co-op program under the curricular practical training (CPT) classification of the USCIS. This means students can work in an approved co-op job while pursuing a degree. To meet the USCIS standards, the job must be related to the student's academic major, and the student must be registered as a co-op student with the university and be in good academic standing. In addition, students can work as full or part time co-ops.*
- *Upon registration for co-op, the International Center issues a new page that is added to the SEVIS I-20. This page contains the student's start and finish dates for the work term and the employer's information. It is unlawful for international students to work off-campus without appropriate authorization from the International Center.*
- *Because of frequent changes in regulations by USCIS, we strongly suggest you to talk with The International Student Affairs prior submitting your job application to any employers.*

# FUNDING SOURCES: GRADUATE ASSISTANTSHIPS

ONCE YOU HAVE BEEN PAIRED WITH AN ADVISOR, YOU ARE ELIGIBLE FOR FINANCIAL ASSISTANCE WHICH TYPICALLY PAYS TUITION, FEES, AND A STIPEND. THE TYPES OF FUNDING THAT GRADUATE STUDENTS IN THE DEPARTMENT OF CHEMICAL ENGINEERING CAN RECEIVE, INCLUDING A MIXTURE OF THOSE LISTED BELOW, ARE AS FOLLOWS:

## TEACHING ASSISTANT (TA), DEPARTMENT OF CHEMICAL ENGINEERING:

*IF YOU ARE A TEACHING ASSISTANT, THE DEPARTMENT OF CHEMICAL ENGINEERING WILL FUND YOU EITHER AS A HALF TIME TA (HALF STIPEND) OR FULL TIME TA (FULL STIPEND). FULL TIME TA'S ARE REQUIRED TO WORK 20 HOURS PER WEEK (HALF TIME TA, 10 HRS.) FOR A PROFESSOR(S) WHO IS TEACHING AN UNDERGRADUATE COURSE. TYPICAL DUTIES INCLUDE GRADING PAPERS AND PROVIDING ASSISTANCE WITH HOMEWORK, LABS AND PROJECTS.*

## RESEARCH ASSISTANT (RA), RESEARCH CENTER:

*DEPENDING ON WHAT TYPE OF RESEARCH PROJECT YOU ARE WORKING ON, YOU CAN BE FUNDED AS A RESEARCH ASSISTANT THROUGH ONE OF THE THREE CENTERS FOR RESEARCH WHERE YOU ARE REQUIRED TO WORK AT LEAST 20 HOURS PER WEEK ON RESEARCH:*

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## CENTER FOR ENERGY SYSTEMS RESEARCH:

As of 2009, the faculty in the department Chemical Engineering associated with the Center for Energy Systems Research, include:

Dr. Pedro E. Arce

Dr. Joseph J. Biernacki

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## Contact information:

**CENTER DIRECTOR:** DR. SASTRY MUNUKUTLA ([SMunukutla@tntech.edu](mailto:SMunukutla@tntech.edu))

**SECRETARY:** Mrs. Sandy Garrison ([SGarrison@tntech.edu](mailto:SGarrison@tntech.edu)) handles the funding from the energy center for the graduate students.

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## CENTER FOR THE MANAGEMENT, UTILIZATION AND PROTECTION OF WATER RESOURCES:

As of 2009, the faculty in the department of Chemical Engineering associated with the Water Center include:

Dr. Pedro E. Arce

Dr. Joseph J. Biernacki

Dr. Donald J. Visco

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## CONTACT INFORMATION:

**CENTER DIRECTOR:** DR. DENNIS GEORGE ([dgeorge@tntech.edu](mailto:dgeorge@tntech.edu))

**SECRETARY:** Mrs. Mary Williford ([mwilliford@tntech.edu](mailto:mwilliford@tntech.edu)) handles the funding from the water center for the graduate students.

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## CENTER FOR MANUFACTURING RESEARCH (CMR):

As of 2009, the faculty in the department of Chemical Engineering associated with the CMR include:

Dr. Cynthia Rice-York

Dr. Pedro E. Arce

Dr. Joseph J. Biernacki

Dr. Ileana Carpen

Dr. Holly Stretz

Dr. Donald Visco

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## CONTACT INFORMATION:

**CENTER DIRECTOR:** DR. KENNETH CURRIE ([kcurrie@tntech.edu](mailto:kcurrie@tntech.edu))

**SECRETARY:** *Mrs. Darlene Weigand* ([dwiegand@tntech.edu](mailto:dwiegand@tntech.edu)) handles the funding from the CMR for the graduate students.

## FELLOWSHIP, OFFICE OF RESEARCH AND GRADUATE STUDIES:

*DIVERSITY FELLOWSHIPS ARE AVAILABLE FROM TENNESSEE TECH THROUGH THE OFFICE OF RESEARCH AND GRADUATE STUDIES. ELIGIBILITY REQUIREMENTS AND HOW TO APPLY FOR THE DIVERSITY FELLOWSHIP ARE LISTED ON THIS WEBSITE:*

*[HTTP://WWW.TNTECH.EDU/GRADUATESTUDIES/DIVERSITY\\_FELLOWSHIPS.HTML](http://www.tntech.edu/graduatestudies/diversity_fellowships.html)*

*REQUIREMENTS FOR THE DIVERSITY FELLOWSHIP INCLUDE WORKING 20 HOURS PER WEEK ON RESEARCH AND MAINTAINING A CUMULATIVE GPA OF AT LEAST 3.0.*

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CONTACT INFORMATION:

**DIRECTOR OF RESEARCH:** DR. ROBBY SANDERS ([rsanders@tntech.edu](mailto:rsanders@tntech.edu))

**DIRECTOR OF FINANCIAL AID:** MR. LESTER MCKENZIE ([Lmckenzie@tntech.edu](mailto:Lmckenzie@tntech.edu))

PROFESSORS' GRANTS:

*PROFESSORS IN THE DEPARTMENT OF CHEMICAL ENGINEERING OFTEN HAVE GRANTS AVAILABLE TO FULLY FUND GRADUATE STUDENTS TO WORK ON A SPECIFIC RESEARCH PROJECT.*

EXTERNAL FUNDING RESOURCES:

*SEVERAL RESOURCES EXIST FOR GRADUATE STUDENTS TO APPLY FOR EXTERNAL FELLOWSHIPS TO FUND THEIR EDUCATION; POPULAR ONES ARE LISTED BELOW:*

*NATIONAL SCIENCE FOUNDATION GRADUATE RESEARCH FELLOWSHIP PROGRAM*

<http://www.nsfgrfp.org>

*DEPARTMENT OF ENERGY GRADUATE FELLOWSHIPS:*

<http://www.energy.gov>

*THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION WEBSITE LISTS MANY OTHER AVAILABLE FELLOWSHIPS:*

<http://www.asee.org/fellowships/index.cfm>

# TRANSFER STUDENTS

Fill out the graduate admission application or apply online as soon as possible. Minimum admission requirements are same as graduate school admission requirements. Go to graduate school website to find out other information relevant to your application:

<http://www.tntech.edu/graduatestudies/>

Requirements Include:

- *Official academic transcripts from the institutions you attended including the current school in which you are studying*
- *THREE letters of recommendation*
- *Bank statement of available funds*
- *Affidavit of support from sponsor*
- *Curriculum Vitae*
- *Statement of purpose*
- *Supporting documents (i.e. Health form, Assistantship/Fellowship form, etc.)*

Forms are available at

<http://www.tntech.edu/graduatestudies/forms.html>

## GRE AND TOEFL REQUIREMENTS

To get an unconditional admission you need to provide GRE score of 1000 including both Verbal and Analytical sections. International students need to provide TOEFL score of 80(ibt). In some cases you may have chances of getting admission conditionally even if you do not meet the above requirements.

## GPA REQUIREMENT:

To get an unconditional admission you need to have at least 3.0 GPA (on 4.0 scale) in your undergraduate studies and you must maintain at least 3.0 GPA in the graduate program you are in right now.

International students are needed to produce non-immigration documents

- *Copy of your Passport,*
- *Copy of your Visa,*
- *Copy of your I-94,*
- *Copy of I-20 of your current school.*

ONCE YOUR ADMISSION HAS BEEN FINALIZED, YOU NEED TO GO TO THE GRADUATE ADMISSION OFFICE OF YOUR CURRENT SCHOOL AND ASK THEM TO TRANSFER YOUR SEVIS NUMBER TO TTU. INTERNATIONAL STUDENTS NEED TO FILL THE INTERNATIONAL STUDENT ADVISOR FORM TO BE SENT TO TTU DIRECTLY FROM THE ADMISSION OFFICE OF YOUR CURRENT SCHOOL. WHILE COMING TO TTU YOU HAVE TO BRING ONE OFFICIAL ACADEMIC TRANSCRIPT FROM THE SCHOOL

## TRANSFER CREDITS:

**A STUDENT CAN TRANSFER MAXIMUM OF 6 CREDIT HOURS FROM THE PREVIOUS SCHOOL AFTER APPROVED BY THE FACULTY OF CHEMICAL ENGINEERING DEPARTMENT AT TTU.**

FOR APPLICATION DEADLINES AND OTHER INFORMATION CONTACT THE GRADUATE SCHOOL.

# TRANSPORTATION

## AIRPORT PICKUP:

The nearest airport to Cookeville is Nashville International Airport. It is 80miles West of Cookeville and is most easily travelled to by use of I-40.

### **The best ways to find a transportation to and from the Airport are:**

- Contact International Office at:
- <http://www.tntech.edu/international/>
- E-mail: [Intl\\_adm@tntech.edu](mailto:Intl_adm@tntech.edu)
- Phone: (931) 372-3233

### **TRANSPORTATION VIA THE INTERNATIONAL OFFICE MUST BE DONE 15DAYS IN ADVANCE.**

- Contact Southern Skies Airport Xpress to pick you up to the Nashville International Airport. You may contact them at: 1-800-726-1284. The fee is around \$65.

THERE IS NO BUS SYSTEM IN COOKEVILLE. If student needs a ride somewhere they can use the U-CART system. Please check their website for more information.

<http://www.ucarts.org/about.html>

Phone: 931-528-1127

**HOURS: UCARTS OPERATES MONDAY THROUGH FRIDAY FROM 6.00A.M. TO 6.00P.M. UCARTS VANS DO NOT OPERATE ON SATURDAYS, SUNDAYS , NEW YEAR'S DAY, MLK HOLIDAYS, MEMORIAL DAY, FOURTH OF JULY, LABOR DAY, THANKSGIVING DAY OR CHRISTMAS DAY.**

OTHER TAXI SERVICES:

- *Affordable Cab: 931-372-0254 or 931-526-4499*
- *Cookeville Cabs: 931-372-2227*
- *Selby's Cab Co: 931-372-7588*

# APARTMENTS IN COOKEVILLE

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THE BEST WAYS TO FIND AN APARTMENT IN COOKEVILLE ARE:

- *Drive around and look for "For Rent" signs*
- *Looking online at Herald – under classifieds – "for rent" – they update once per week and often have houses/duplexes available as well. Their website is:*

[www.herald-citizen.com](http://www.herald-citizen.com)

- *Similarly visit:*

[www.localsalesnetwork.com](http://www.localsalesnetwork.com)

*Unfortunately, there are not many websites dedicated to finding an apartment in Cookeville, so the best method is to look in the classifieds, or find the listings in the phonebook and calling them one by one.*

HERE ARE SOME ADDITIONAL WEBSITES:

- *Rental guide for the upper Cumberland:*  
<http://www.rentalguideuppercumberlands.com/index.cfm>
- *Buckner Properties:* <http://www.bucknerproperties.com/>
- *Jerry C. Gaw Properties:* <http://www.jerrycgawproperties.com/>
- *Furnished apartments, Eagles Landing:*  
<http://eagleslandingtt.homesandland.com/>
- *Saxony Apartments:* <http://www.saxonyapartmenthomes.com/>

# SOURCES FOR TRAVEL FUNDS

**CHEMICAL ENGINEERING GRADUATE STUDENTS CAN ACQUIRE TRAVEL FUNDS TO ATTEND CONFERENCES IF AND ONLY IF THEY ARE GIVING A POSTER OR ORAL PRESENTATION AND IF THEY PRESENT A POSTER AT THE ANNUAL TTU STUDENT RESEARCH DAY.**

TYPICALLY, TRAVEL FUNDS ARE OBTAINED FROM THE FOLLOWING SOURCES: THE STUDENT MONIES ALLOCATION COMMITTEE, (SMAC), RESEARCH CENTERS (I.E., CENTER FOR THE MANAGEMENT, UTILIZATION, AND PROTECTION OF WATER RESOURCES, CENTER FOR MANUFACTURING RESEARCH, AND CENTER FOR ENERGY SYSTEMS RESEARCH), COLLEGE OF ENGINEERING, THE DEPARTMENT OF CHEMICAL ENGINEERING, EXTERNAL FUNDING SOURCES (I.E. TRAVEL GRANTS), AND THE STUDENT'S ADVISOR.

**IT IS USUALLY THE STUDENT'S RESPONSIBILITY TO PAY THE COST OF THEIR TRIP UP-FRONT AND THEN THEY WILL BE REIMBURSED WHEN THEY RETURN. NOTE THAT SMAC WILL NOT PAY FOR FOOD (IN THE FORM OF PER DIEMS) – THIS IS LEFT UP TO THE REMAINING SOURCES PROVIDING TRAVEL FUNDS.**

## SMAC

*“Any student organization registered with the Office of Student Activities and in good standing with the university can apply for Chapter 606 funds.”*

- *Only ONE application from CEGRA per semester is accepted. In the fall semester, the one application that is allowed is used to obtain travel funds for the National AIChE conference.*
- *Chapter 606 will fund no more than **5%** of the total amount of money available in the Chapter 606 account (this varies from semester to semester) or no more than **66%** of the total funds needed for the project.*
- *ALL RECEIPTS MUST BE TURNED INTO THE SMAC IN ORDER TO GET REIMBURSED.*
- *The President of CEGRA and a project chairperson (usually a fellow officer) should complete the form (available on the website, as shown below) with signatures,*

and take **14 copies** to the Student Affairs office (RUC 221) before noon at least one week prior to the next scheduled meeting. At this time, a meeting will be scheduled for the representatives of CEGRA to present their case in front of the SMAC committee. The committee will then determine (on the same day) how much money CEGRA will receive from SMAC. The dates of the meetings are located on SMAC's website:

- <http://www.tntech.edu/studentaffairs/chapter606.html>

## RESEARCH CENTERS AND COLLEGE OF ENGINEERING

### RESEARCH CENTERS:

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#### **Before the conference:**

- *Students who are currently supported monetarily by one of the research centers can request travel funds from them also. The president of CEGRA will compose a letter (like the one shown below) requesting funds for the appropriate students who wish to obtain travel funds from research centers. The amounts of money requested are only an estimation at this point. This letter will then be sent to the current graduate program coordinator (Dr. Visco in the example below) who will then send it to the directors of the respective research centers. Note: The CEGRA president should also keep the department secretary and the faculty informed of the requests that are made for travel funds.*
- *After the conference:*
- *When the graduate students return from the conference, they should turn in their receipts from the trip to the financial analysts of the research centers. The students will then be reimbursed in addition to a per diem (typically).*

## COLLEGE OF ENGINEERING:

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THE PROCEDURE OUTLINED IN THE SECTION ABOVE IS ALSO FOLLOWED TO REQUEST MONEY FROM THE COLLEGE OF ENGINEERING. NOTE THAT THE COLLEGE OF ENGINEERING CAN PROVIDE A MAXIMUM OF \$250 PER STUDENT. PLEASE SEE THE EXAMPLE LETTER BELOW.

## DEPARTMENT OF CHEMICAL ENGINEERING:

STUDENTS CAN SPEAK WITH THE CHAIR OF THE CHEMICAL ENGINEERING DEPARTMENT ABOUT REQUESTING FUNDS FROM THE DEPARTMENT IF THEY HAVE ALREADY ACQUIRED A PORTION OF THE FUNDS FROM OTHER SOURCES, OR IF THE CHAIR IS THEIR PRIMARY ADVISOR.

## EXTERNAL FUNDING SOURCES:

OFTENTIMES STUDENTS CAN OBTAIN TRAVEL GRANTS FROM EXTERNAL SOURCES, SUCH AS THE ORGANIZATION SPONSORING THE CONFERENCE THEY ARE PRESENTING AT. PLEASE CHECK THE CONFERENCE WEBSITES TO APPLY FOR THESE OPPORTUNITIES.

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SMAC FORM:

Submit **14** typed copies plus original of each application. Submit application within seven (7) days of the next meeting by 12 noon.

Questions contact the Student Affairs Office RUC 221  
Or call 372-3411

Office Use Only

Date Recd. \_\_\_\_\_

Amt. Recd. \_\_\_\_\_

Req. No. \_\_\_\_\_

APPLICATION FOR CHAPTER 606 FUNDING

**ORGANIZATION:** Chemical Engineering Graduate Research Association  
Campus Box 5013

Faculty Advisor: Dr. Venkat Subramanian Phone: 372-3474

President of Organization: Jennifer Pascal japascal21@tntech.edu

Project Chairperson: Hope Sedrick

Have you applied and received Chapter 606 funding in the past five (5) years? If so, when and how much?  
Yes, Approximately \$3400 in Spring 2008 and Fall 2007 and approximately \$3000 in Fall 2006

Date of Event: November 16-21, 2008 Date Funds Needed: Nov 1, 2008

Description of Project Attend AIChE Centennial National Annual Conference in Philadelphia, PA to present on research and also to represent the Chemical Engineering graduate program in its efforts to recruit/attract a more diverse applicant pool

Total Funds Needed for Project: \$10900

a. Available from Other Sources: Request submitted; amount is yet to be determined

b. Requested from Chapter 606: \$10900

Itemized Projection of Expenditures from Other Sources:

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Itemized Projection of Expenditures for Chapter 606:

**All money will be spent as allocated in the travel expenses section of this document**

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Travel Expenses:

Destination: **Philadelphia, PA**

Method of Travel: University Car \_\_\_\_\_ Personal Car \_\_\_\_\_ Plane x \_\_\_\_\_ Other \_\_\_\_\_

Number in Traveling Party: 10

Estimate

Mileage \_\_\_\_\_ @ \_\_\_\_\_

Fares 10 @ \$300 3000

Lodging: Number of Nights 25 @ \$200 5000

Registration Fees 10 @ \$290 2900

Miscellaneous Reimbursable Expenses:

Specify \_\_\_\_\_

Total Estimated Travel Expense

10900

**\*Note: Chapter 606 guidelines do not permit the disbursement of funds for student meals or for any expense for a faculty advisor.**

Explain the other sources of possible funding that were explored and the results of the explorations: College of Engineering: Request for funds submitted; amount yet to be determined \_\_\_\_\_ Department of

Chemical Engineering: Request for funds submitted; amount yet to be determined \_\_\_\_\_

Individual registrants' research centers and/or grants requests submitted: amount yet to be determined \_\_\_\_\_

In what way will the proposed project benefit TTU students outside the organization applying (reasons stated should include other benefits as well as promotion of University prestige): **Presentation of research at the ACS/AIChE conference will provide our graduate students with the opportunity to showcase, on a national/international stage, the level and sophistication of research currently being undertaken here at TTU. Attendance will also permit our students to interact with and to promote TTU's Chemical Engineering graduate program to students from across the nation and other countries. This will be in direct alignment with the department's current initiative to attract a more diverse (in terms of education, gender, race and national origin, etc.) applicant pool. A more diverse student population will further enrich the already great and unique learning experience that TTU has to offer**

\*Note: Requests for funds including services for an individual or group must follow TTU policies and procedures concerning a personal services contract and/or agreement.

We agree that: 1. Any funds allotted will be used solely for the purpose stated.

2. The Chapter 606 Student Monies Allocation Committee has the right to review this organizations financial standing.

3. This organization will be responsible for filing an After Allocation Report with the committee following the event or purchase.

4. Any excess funds will be reimbursed to the Chapter 606 fund.

5. Everything stated above is true.

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Faculty Advisor

Project Chairperson

President

(Original signatures are required)

ATTACH ANY ADDITIONAL INFORMATION

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EXAMPLE LETTER TO REQUEST FUNDS FROM A RESEARCH CENTER:

September 2, 2009

Dr. Kenneth R. Currie

Director of the Center for Manufacturing Research

Tennessee Technological University

Dear Dr. Currie:

I am writing on behalf of Drs. Ileana Carpen and Joseph Biernacki for the department of chemical engineering to request the Center for Manufacturing Research for a travel grant for chemical engineering Master's student, Deepika Gollamandala and chemical engineering PhD student, Pravin Kannan. Deepika is under the advisement of Dr. Ileana Carpen, and Pravin is advised by Dr. Biernacki. They plan to attend the American Institute of Chemical Engineers (AIChE) national conference in November 2008. Deepika and Pravin are giving an oral presentation and poster presentation, respectively about their research related to the work they conduct with the Center for Manufacturing Research. Through this conference, they will gain the experience of presenting research at the highest scientific levels. They will also be able update themselves with advances in chemical engineering which will enhance her future research. We are also requesting funds from the Student Monies Allocation Committee, College of Engineering as well as the department of Chemical Engineering.

Please find the attached abstract for the conference and list of expenses.

Sincerely,

Dr. Donald P. Visco Jr.

Professor, Dept. of Chemical Engineering

Tennessee Technological University

Email: [dvisco@tntech.edu](mailto:dvisco@tntech.edu)

Phone: 931-372-3606

## Factors Affecting Nanoparticle Dispersion

Deepika R. Gollamandala and Ileana C. Carpen

Department of Chemical Engineering, Tennessee Tech University, Box 5013, Cookeville, TN 38505

Addition of nanosized particles to a polymer solution/matrix can lead to new and improved properties over conventional composites using larger filler particles. In this work, we investigated systems of nanoparticles and polymer using Brownian dynamic simulations. The shape of the nanoparticles was considered to be spherical and the polymer architecture was modeled as bead spring chains. The degree of dispersion and agglomeration in the system were characterized by mean square displacement. Various factors, including size of nanoparticles, nanoparticle-polymer interaction, polymer chain length, and relative volume fractions, affect the dispersion of nanoparticles in the polymer matrix. In this study, the influence of polymer chain length and size of nanoparticles were analyzed and presented.

Kinetics of Thermal Decomposition of Expanded Polystyrene In Different Gaseous Environments

**Pravin Kannan**<sup>1</sup>, Joseph J. Biernacki<sup>1</sup>, Donald P. Visco<sup>1</sup>, and William Lambert<sup>2</sup>.

(1) Chemical Engineering, Tennessee Technological University, Department of Chemical Engineering, P.O. Box 5013, Cookeville, TN 38505, (2) Chemical Engineering, University of Nebraska at Lincoln, Lincoln, NE

The characteristics of thermal decomposition of expanded polystyrene (EPS) foams were studied in various gaseous environments, both oxidizing and non-oxidizing, over a narrow range of heating rates between 1 and 30 K/min using non-isothermal thermo gravimetric analysis (TGA). A modified integral-optimization technique was developed for multiple rate-controlling decomposition reactions. Results from kinetic data analysis shows that the activation energy of EPS foam decomposition in air is much less than in non-oxidizing environments, including nitrogen, helium and argon. Qualitative mass spectrometric studies of EPS pyrolysis gases revealed the differences in EPS foam decomposition mechanism between various gaseous environments. Furthermore, it was found that the non-oxidizing gases, especially helium, have a significant effect on the decomposition efficiency of the EPS foam.

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AICHE ANNUAL MEETING PHILADELPHIA, PENNSYLVANIA NOVEMBER 2008:  
CONFERENCE EXPENSES PER STUDENT

Travel Period: November 16<sup>th</sup> to November 21<sup>st</sup> , 2008

Travel Expenses:

<b>Item</b>	<b>Amount</b>
Round Trip plane Tickets	\$232.50
Hotel stay for 5 nights (\$100 per night)	\$500.00
AIChE registration fees	\$290.00
Transportation to Nashville and other	\$160.00
	<hr/>
	Total: \$1182.50

**Additional Funds:**

<b>From</b>	<b>Amount</b>
Student Chapter	\$500.00
Graduate Study and Research office	\$250.00
Department of Chemical Engineering	\$X.XX
CMR	\$X.XX

MEMORANDUM

**To:** Dr. Subramaniam Deivanayagam  
Associate Dean for Graduate Study and Research  
College of Engineering

**From:** Dr. Donald P. Visco Jr.  
Professor, Department of Chemical Engineering

**Date:** October 29<sup>th</sup>, 2008

**Subject:** Travel funds

I am writing on behalf of the Department of Chemical Engineering to request the Office of Research and Graduate Studies for travel grants for the following chemical engineering graduate students to attend the American Institute of Chemical Engineers (AIChE) national conference from November 16<sup>th</sup> - November 21<sup>st</sup>, 2008: Deepika Gollamandala, Vasanta Pallem, Jennifer Pascal, Hope Sedrick and Jeff Thompson. A breakdown of the individual requests and approvals by advisors is as follows:

Deepika Gollamandala is advised by Dr. Ileana Carpen and will be giving an oral presentation entitled "Factors Affecting Nanoparticle Dispersion." The estimated cost of attendance for Deepika is \$1180.00. She has funding of \$1000.00 from the Student Monies Allocations Committee (SMAC) as well as the Center for Manufacturing Research (CMR), so I will be requesting \$180.00 from the Office of Research and Graduate Studies on her behalf.

Vasanta Pallem is advised by Dr. Holly Stretz and will be giving an oral presentation entitled "Biomedical Imaging Gold Nanoparticles: Interactions with Humic Substances." The estimated cost of attendance for Vasanta is \$1180.00. She has funding of \$1000.00 from the Student Monies Allocations Committee (SMAC)

as well as the Water Center, so I will be requesting \$180.00 from the Office of Research and Graduate Studies on her behalf.

Jennifer Pascal is advised by Dr. Pedro Arce and will be giving one oral presentation and two poster presentations entitled “Optimal Separation Times In An Electrical Field Flow Fractionation (EFFF) Separator: Effect of Electroosmotic Flow,” An Electrokinetic-Hydrodynamics-Ekhd Based Approach to Determine Effective Transport Parameters: Illustrative Results and Comparison, and “Electrokinetic-Hydrodynamics (EKHD): An Efficient Framework for Systematic Research,” respectively. The estimated cost of attendance for Jennifer is \$1180.00. She has funding of \$500.00 from the Student Monies Allocation Committee, so I will be requesting \$250.00 from the Graduate Study and Research office on her behalf. The remainder of her costs will be funded by the Department of Chemical Engineering.

Hope Sedrick is advised by Dr. Pedro Arce and will be giving a poster presentation entitled “Optimal Separation Times with Varying Electrical Fields: Comparison.” The estimated cost of attendance for Hope is \$680.00 (She will only be staying for one day). She has funding of \$500.00 from the Student Monies Allocations Committee (SMAC), so I will be requesting \$180.00 from the Graduate Study and Research office on her behalf.

Jeffery Thompson is advised by Dr. Holly Stretz and will be giving a poster presentation entitled “Thermoresponsive Microparticle Gels for Electrophoresis: PNIPAm Templated Page.” The estimated cost of attendance for Jeffery is \$1180.00. He has funding of \$1000.00 from the Student Monies Allocations Committee (SMAC) as well as Dr. Holly Stretz, so I will be requesting \$180.00 from the Graduate Study and Research office on his behalf.

# INTERNATIONAL STUDENT ADMISSION REQUIREMENTS FOR CHEMICAL ENGINEERING GRADUATE PROGRAM

- *International student applications for admission to the graduate school must be filed to the Vice president of Graduate Studies at least 6 months in advance.*
- *TOEFL - 550 (79 iBT, 213 Computer-based)*
- *GRE - 1000 total on the verbal/quantitative portions and 3.5 on the analytical writing portion*
- *Verification of adequate financial support from parents or sponsors, including the amount and length of time funds will be provided.*
- *Verification of sponsor's ability to provide support from a financial institution where funds are on deposit.*
- *Submission of 3 letters of recommendation (true letters preferred over the PDF form)*
- *Official transcripts from your bachelor's institution and any institutions attended since that degree*
- *Grade Point Average on Bachelor's degree of at least 3.0*
- *Submit Student Health Form: 2 doses of MMR vaccination required*

## THE FOLLOWING ARE THE REQUIREMENTS IN ORDER TO MAINTAIN LAWFUL F-1 STATUS:

- *Valid Passport*
- *Valid Visa*
- *I-20 Certificate of Eligibility*

- *I-94 Arrival/Departure card*
- *Register for a minimum of 9 credit hours for M.S., and a minimum of 6 credit hours for a PhD degree per semester*
- *Limit on-campus employment to 20 hours per week when school is in session*

For more information on Immigration see the link below:

[http://www.tntech.edu/international/immigration\\_require.html](http://www.tntech.edu/international/immigration_require.html)

For further enquiries contact International Student Affairs

**PHONE:** 931 372 3634

**E-MAIL:** [Intl\\_adm@tntech.edu](mailto:Intl_adm@tntech.edu)

**ALTERNATE E-MAIL:** [ttunewintl@yahoo.com](mailto:ttunewintl@yahoo.com)

# STUDENT ORGANIZATIONS

STUDENT ORGANIZATIONS THAT MIGHT BE OF INTEREST TO GRADUATE STUDENTS IN CHEMICAL ENGINEERING INCLUDE:

## CHEMICAL ENGINEERING GRADUATE RESEARCH ASSOCIATION (CEGRA):

Faculty Advisor: Dr. Cynthia Rice-York (ChE)

- *Monthly meetings/seminars given by faculty/students from around campus*
- *Obtains funds for graduate students to attend conferences*
- *Conducts fundraisers (beer brewing class, for example)*
- *Interacts with faculty during monthly lunches*

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (AIChE):

Faculty Advisor: Dr. Ileana Carpen (ChE):

- *Student chapter of the national organization*
- *Monthly meetings for undergraduate and graduate students to discuss social activities, conferences, AIChE awards, E-Car Team, annual chemical engineering department banquet*
- *Obtains funds to attend national and regional AIChE conferences*

## STUDENT AFFILIATES OF THE AMERICAN CHEMICAL SOCIETY (SAACS):

Faculty Advisor: Dr. Dan Swartling (Chem)

- *Monthly meetings*
- *Outreach to encourage others to consider Chemistry as a college major*
- *Opportunities to attend national and regional ACS conferences*
- *Sigma Xi, The Scientific Research Society: President: Dr. Robby Sanders (Office of Research and Graduate Studies):*
- *Monthly seminars given by faculty/students from various departments on campus*
- *Awards and fellowships from the national organization are available*
- *Annual banquet*

## SOCIETY OF WOMEN ENGINEERS (SWE):

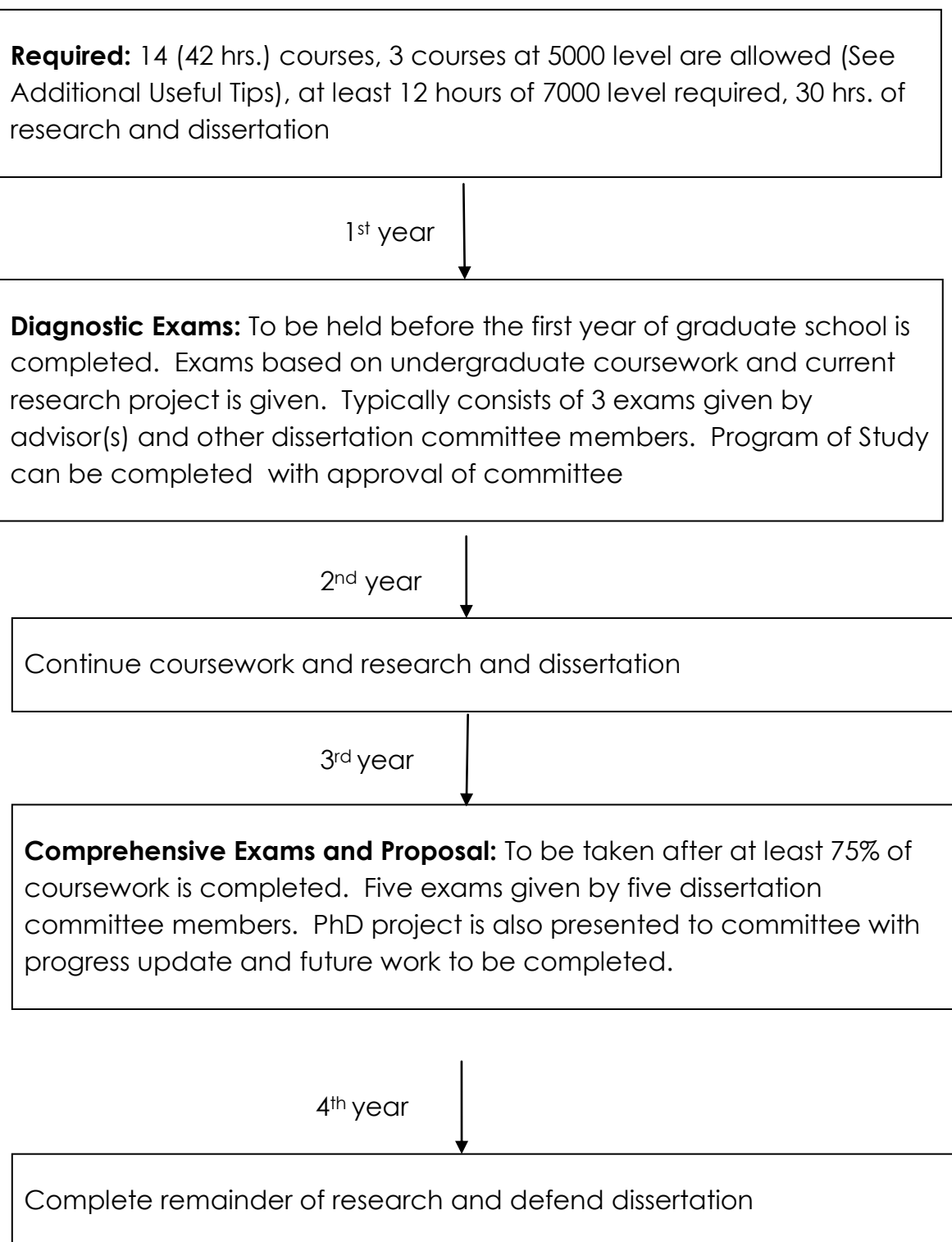
Faculty Advisor: Kris Craven (BE)

- *Opportunities to attend national and regional SWE conferences*
- *Fundraisers (bake sale, t-shirt sale, for example)*
- *Actively involved in campus events (tailgating at football games, for example)*

A COMPLETE LIST OF STUDENT ORGANIZATIONS ON CAMPUS CAN BE FOUND AT:

[HTTP://WWW.TNTECH.EDU/LIFE/ORGS.HTML](http://www.tnitech.edu/life/orgs.html)

# DIRECT PHD TIMELINE



## ADDITIONAL USEFUL TIPS FOR DIRECT PHD STUDENTS:

- *Assemble the graduate thesis committee prior to completion of first year of graduate school which shall consist of at least five voting members (THREE OF WHICH MUST BE FROM WITHIN THE DEPARTMENT).*
- *Be sure to complete diagnostic exams BEFORE first year of graduate school is completed IN A TIMELY MANNER.*
- *5000 level courses are not allowed for the standard PhD program, so the mention of being involved in the direct PhD program is especially important in getting the program of study approved.*
- *If diagnostic exams are passed, complete a program of study (MUST BE APPROVED BY ASSOCIATE DEAN FOR GRADUATE STUDIES, FIRST) and submit to the office of research and graduate studies.*

# GUIDELINES AND TIMELINE FOR MASTERS OF SCIENCE (MS) STUDENTS

The following guidelines are in addition to the University's policies which are enunciated in the TTU Graduate Catalog which also contains information specific to MS program in chemical engineering.

- *A new student is highly encouraged to meet and discuss the mutual research interests with all the faculty members in the department. Form-A should be completed and submitted to the graduate program coordinator within 30 days from the date of enrollment.*
- *The chairperson of the advisory committee will be selected by the department chair in consultation with the student.*
- *A full-time student is normally expected to graduate within two years from the date of enrollment. If the student needs additional time to complete his/her thesis, the student should submit a request for extension to the graduate program coordinator mentioning the reason for delay and the expected date of graduation two months before the deadline.*
- *The student is expected to finalize his/her advisory committee (minimum three members) and prepare a program of study before the end of the second semester. The advisory committee will send a brief report to the graduate program coordinator on the progress of the student every semester.*
- *The student should inform and obtain the permission of the chair person of the advisory committee before applying for any internship or co-op position. It is the responsibility of the student to show that the internship /co-op position is directly related to the field of research performed by the student.*

- *If the student has signed a contract for assistantship, he/she may not be permitted to leave in the middle of the appointment period.*
- *The student is expected to have submitted at least one peer-reviewed research article before defending his/her thesis. The research articles should be cited in the thesis abstract fliers. A flier announcing the thesis defense should be distributed widely in the campus by the student.*
- *The student should submit a draft copy of his/her thesis of their thesis (approved by the committee chair person) to all the advisory committee members at least 15 days ahead of their scheduled thesis date and time.*

## TIMELINE

The following gives an approximate timeline from the date of enrollment.

Month 1: Students talk to the graduate faculty, give their first three choices for their advisers

45 Days: Graduate advisers assigned

End of second semester: Formation of thesis committee

End of third semester: Progress report submitted by the advisory committee to the graduate program coordinator

Month 22: Deadline for submitting a request to extend the duration of the MS program beyond 24 months

Month 23: Should have submitted/published at least one peer reviewed research article  
Schedule thesis date and time 15 days ahead of time Submit thesis copies (finalized after the revisions from the advisor) to the advisory committee members

Month 24: Defend and graduate.

## ADVISOR SELECTION FORM

Master of Science (MS) student's choices for the Chairman of the advisory committee

My first choice is Dr. \_\_\_\_\_ because

My second choice is Dr. \_\_\_\_\_ because

My third choice is Dr. \_\_\_\_\_ because

Name

Date

Signature

# CURRENT CHEMICAL ENGINEERING FACULTY AND STAFF

DR. PEDRO E. ARCE

PROFESSOR AND CHAIR

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## CONTACT INFO:

Office: Room 214, Prescott Hall

Phone: (931) 372.3189

Fax (931) 372.6352

E-mail: [parce@tntech.edu](mailto:parce@tntech.edu)

## EDUCATION

Ph.D., Chemical Engineering, Purdue University, 1990

M.S., Chemical Engineering, Purdue University, 1987

Certificate of English Studies, Anglo-Continental School of English, Bournemouth, England, 1981

Postgraduate Studies, National Council of Research, Argentina, CONICET-UNL, 1978-1983

Chemical Engineering Degree, Universidad Nacional del Litoral (UNL), Santa Fe, Argentina, 1977, Minor in Heterogeneous Catalysis

## RESEARCH INTERESTS

Electrokinetics and Electrophoresis

Non-thermal High Oxidation Methods

Nano-structured soft (gel and colloidal) materials for bioseparations and drug delivery

Engineering Education

## RESEARCH STATEMENT

The current focus of Dr. Arce's research efforts is on the analysis and prediction of the Rate of Transport and Consumption of Solutes (colloidal particles, macromolecules, contaminants, and drugs) in multiscale systems ranging from the earth environment (soils) to microenvironments (microfluidics) and the nanoscale (gel and colloidal materials with internal architectures). In particular, he is interested in advancing the understanding, the development, and/or the improving of applied field sensitive technologies. This is a relevant family of problems in modern chemical and biological engineering with one interesting characteristic - its common scientific core that permeates all systems. This core includes electrostatics, colloidal and microhydrodynamics, chemical kinetics, and bio-particle/surface interaction. Applied field process technologies have applications in soil remediation, contaminant degradation, material development for bioseparations and drug delivery, and biomicroflows (kidney, arteries, and lungs), among others. Dr. Arce's group has recently identified the word Electrokinetic-Hydrodynamics or EKHD to describe applications whose applied field is electrical.

For "low" values of the electrical field (in the order of millivolts), our past research efforts have yielded novel nano-templated gels with unique characteristics for electrophoresis separation, uncovered the key role of the internal architecture of the material in predicting transport rates in (isotropic and non-isotropic) porous or fibrous media, and led to a priori design or implementation criteria in capillary and free-flow electrophoresis devices and electrokinetic soil remediation. For "high" field values (in the order of several kilovolts), our group has pioneered the application of non-thermal plasma to organic contaminant reduction (removal of phenol, fumics, and proteins) in liquid phase and suggested fundamental reactor design equations for the gas phase. In addition, promising experimental results have been obtained in particle electrosettling in water.

Current efforts focus on building on previous accomplishments and fostering new and mutually beneficial collaborations. For example, we are developing the next generation of non-thermal plasma reactors in aqueous and gas phase, working on the synthesis and characterization of novel nano-polymer and colloidal-structured materials for bioseparations and drug delivery, and have initiated the analysis and design of micro-electrokinetics devices (MED) for sensing and clinical uses as well as begun studies in bio-electrokinetic remediation in soils.

Studies in Low Reynolds Hydrodynamics and collaboration of colleagues at the Geophysical Fluid Dynamics Institute, GFDI ( Florida State University) have led to the discovery of a novel internal microflow (i.e., “puddle” formation flow) in large drops moving in high viscous fluids. Further experimental and simulations aspects are currently being studied. Micromixing of fluids and Earth Mantle Dynamics are two key applications of this novel flow.

Dr. Arce is deeply committed to the development and enhancement of the efficient learning methodologies in the engineering curricula where his focus is on active and collaborative learning environments and learning techniques of high retention. He has championed the use of the “Colloquial Approach,” the “The Principal Objects of Knowledge or POK’s,” the “(Sport) Coach Model of Instruction,” and more recently, “High Performance Learning Environment or Hi-PeLE,” “Personalized Class Binders or PCB,” and up-scaling approaches of transport and reaction processes in systems with multiscales and multiphases. Dr. Arce is a frequent invited workshop conductor on these topics in Latin American Countries (Argentina, Chile, Paraguay, Peru, and Uruguay) and in the USA (ASEE-SE Annual Meetings).

## RECENT PUBLICATIONS

- *P.E. Arce, M. Quintard, S. Whitaker, 2005, “The Art and Science of Upscaling,” Chapter 1 in Chemical Engineering: Trends and Developments, edited by M.A. Galán and Eva Marin de Valle, John Wiley & Sons, Ltd., England, (2005).*
- *M. Oyanader, P. Arce, A. Dzurik, "Design Criteria for Soil Cleaning Operations in Electrokinetic Remediation. Hydrodynamic Aspects in an Annular Geometry," I&EC Research, 44 (16), 6200 (2005). Invited contribution to the MILORAD P. DUDUKOVIC FESTSCHRIFT: PART 2.*
- *M. Oyanader and P. Arce, "Role of Geometrical Dimensions in Electrophoresis Applications with Orthogonal Fields," Electrophoresis, 26, 2857 (2005).*

- E. Erdmann, M.O. Oyanader, P. Arce, "Effect of Joule Heating and of Material Voids on Free-Convective Transport in Fibrous or Porous Media with Applied Electrical Fields," *Electrophoresis*, 26, 2867 (2005).
- M. Oyanader and P. Arce, "A New and Simpler Approach for the Solution of Electrostatic Potential Differential Equation," *Journal of Colloid and Interface Science*, 284, 315-322 (2005).

## CONTACT INFO:

Office: Room 312, Prescott Hall

Phone: (931) 372.3667

Fax (931) 372.6352

E-mail: JBiernacki@tntech.edu

## EDUCATION

Ph.D., Chemical Engineering, Cleveland State University, 1988

B.S., Chemical Engineering, Case Western Reserve University, 1980

## RESEARCH INTERESTS

Cementitious Materials

Micro-fluidics

Electronic and Structural Materials

## RESEARCH STATEMENT

The primary emphasis of my research group is to develop fundamental kinetic and thermophysical data for materials synthesis. Materials in this case are primarily ceramics, but may include composites of ceramics, metals and polymers. While my specific focus changes from project to project, there are several themes: hydration stoichiometry and kinetics of waste and by-product materials in Portland cement and characterization of the microstructure and transport processes in cement-based materials; kinetics and associated

transport processes for electronic materials; and kinetics of designed organic and inorganic materials for high temperature applications.

Portland cement concrete is second only to water in use. This ubiquitous construction material is the very foundation of our global infrastructure. This common material has been traditionally composed of naturally occurring fine and coarse aggregate, Portland cement and water. Concerns over global warming and ever-increasing stockpiles of solid industrial wastes and by-products has energized efforts to develop modern concrete formulations that incorporate more waste and by-products and less Portland cement. This has been beneficial from an environmental point of view, but also has the potential for improving the durability and strength of concrete. Yet, there are fundamental questions which remain unanswered and obstacles to widespread adaptation of blended-cement products. Uncertainty in the interaction between waste and by-product additives and Portland cement, the stoichiometry of hydration, the chemical stability and transport properties of blended-cement concrete are of critical importance. My cements research group focuses on fundamental interactions between waste and by-products and Portland cement, the kinetics of hydration, stoichiometry of reaction and resulting microstructure and transport processes. We are applying modern analytical tools including synchrotron X-ray diffraction (XRD) and environmental scanning electron microscopy to study these complex chemical reactions in situ rather than post reaction. Existing models for cement, waste and by-product hydration are largely lumped parameter. Our ambition is to build distributed parameter kinetic models with improved predictability and reliability.

Producing electronic materials for production of integrated circuits and other silicon-based devices involve numerous chemical processes. Accurately modeling these processes requires detailed knowledge of the component kinetic and transport processes. My electronic materials group conducts fundamental chemical kinetic studies and builds computations process models including system-level details for optimization and sustained development of existing and new processes.

Rate data for synthesis of new and novel materials such as polymers and polymer precursors, ceramics ( $Ti_3SiC_2$ ,  $MoSi_2$  and composites with SiC, etc.) is of great interest in the automotive, aerospace and electronics industry. The kinetics and associated microstructure of such materials is the subject of our research. Processing of powders by reactive sintering and melt-based process is the primary focus. XRD, SEM and various spectroscopic methods are our primary tools.

## RECENT PUBLICATIONS

- J. J. Biernacki, with the Faculty and Staff, *The Department of Chemical Engineering at Tennessee Technological University*, *Chem. Eng. Ed.*, 42(3) 118-124 (Summer, 2008).
- J. J. Biernacki, P. M. Mellacheruvu and S. Mahajan, *Poisson's Effects in Electrical Field Flow Fractionation*, *J. Separation Sci.*, 31(12), 2219-2230 (2008).
- J. J. Biernacki, A. K. Vazrala and H. W. Leimer, *Sintering of a Class F Fly Ash*, *Fuel*, 87(6) 782-792 (2008).
- B. J. Mohr, J. J. Biernacki and K. E. Kurtis, *Supplementary cementitious Materials for Mitigating Degradation of kraft Pulp fiber-Cement Composites*, *Cem. Concr. Res.*, 37(11) 1531-1543 (2007).
- P. Kannan, J. J. Biernacki and D. P. Visco, Jr., *A Review of the Kinetic Models for Thermal Degradation of Expanded Polystyrene Foam and Application to the Lost Foam Casting Process*, *J. An. App. Pyrol.*, 78(1) 162-171 (January 2007).

# DR. ILEANA C. CARPEN

ASSISTANT PROFESSOR

ΩXE FACULTY ADVISOR

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## CONTACT INFO:

Office: Room 308, Prescott Hall

Phone: (931) 372.3474

Fax (931) 372.6352

E-mail: [ICarpen@tntech.edu](mailto:ICarpen@tntech.edu)

Web: Carpen Research Group

## EDUCATION

Ph.D., Chemical Engineering, California Institute of Technology, 2005

M.S., Chemical Engineering, California Institute of Technology, 2002

B.S., Stanford University, 1999

### Research Areas

Macrorheology of Materials • Flow Stability of Complex Fluids • Colloidal Suspensions

## RESEARCH STATEMENT

Dr. Carpen's general area of research is focused on the microrheology of complex fluids and materials including suspensions, structured gels, and tissue scaffolds. She primarily focused her efforts on describing the rheological behavior of the complex fluid and/or material by computational approaches based on Brownian dynamics simulations to obtain information about system properties (such as viscosity). This information is relevant to improving the understanding of materials at the micro and macro scale and in aiding in the design of materials with an improved performance for a variety of applications including the design of

membranes and scaffolds for tissue support and growth. Dr. Carpen will initially continue focusing her efforts on advanced computer simulations but, at a later stage, she will incorporate experimental efforts in a collaborative fashion.

## RECENT PUBLICATIONS

- *I. Carpen and J. Brady, "Microrheology of Colloidal Dispersions," J. Rheology, To be Submitted.*
- *I. Carpen and J. Brady, "Microrheology of Colloidal Dispersions," Bulletin of APS (Abstract, 2004)*
- *I. Carpen and J. Brady, "Gravitational Instability in Suspension Flow," J. Fluid Mechanics, 472, 201-210 (2003).*
- *J. Brady and I. Carpen, "Second Normal Stress Jump Instability in Non-Newtonian Fluids," J. Non-Newtonian Fluids Mech., 102, 219-232 (2002)*
- *I. Carpen and J. Brady, "Second Normal Stress Instability in non-Newtonian Fluids," Bulletin of APS (Abstract, 2001).*

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RESEARCH INTERESTS

PEM/Direct Formic Acid/Direct Methanol Fuel Cells – freeze dynamics, mechanical and chemical durability testing, Gas Diffusion Layer influence on PEM performance

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## EDUCATION

Ph.D., Chemical Engineering, University of Texas, Austin, 2005

M.S., Chemistry, Texas State University, 1996

B.S., Chemistry, Texas A&M University, 1980

## RESEARCH AREAS

Nanocomposite structure and modeling

High temperature materials and ablatives

Fate and transformation of nanoparticles in surface waters

Novel hydrogel nanocomposites for medical diagnostics

## RESEARCH STATEMENT

Our group is interested in advanced high performance polymer nanocomposites: the processing, characterization and prediction of bulk properties. These materials are often used in extreme environments such as conditions found in rocket ablatives and fire. Materials comprised of polymer and nanoparticles, including montmorillonite clays, carbon nanotubes

and synthetic silicates such as polyoligomeric silsesquioxanes (POSS), offer improvement over traditional composites in mechanical, barrier and thermal properties while maintaining specific gravity and optical clarity. To achieve this level of performance, one must achieve high levels of dispersion and maintain interfacial compatibility and/or form interparticle connectivity. Current research focuses on formation of novel morphologies/networks of montmorillonite and other model nanoparticles (CdSe) which lead to optimized erosion performance. Another thrust is to utilize dispersion to form nanochannels in hydrogels used in medical diagnostics. A third area of research is to understand environmental fate and transformation of metal nanoparticles such as gold or silver in surface waters.

## RECENT PUBLICATIONS

- V. Pallem, H. A. Stretz, M. J. Wells, "Evaluating Aggregation of Gold Nanoparticles and Humic Substances Using Fluorescence Spectroscopy," *Environmental Science and Technology*, submitted 2009.
- J. W. Thompson, H. A. Stretz, P. E. Arce, "Thermoresponsive Microparticle Hydrogels," US 12/275,253, WO 2009/067666 A2. 05-28-2009, Tennessee Technological University.
- H. A. Stretz, N. Palla, "Modulus-based Scaling Parameter for Process Control of Exfoliation Efficiency in Nanocomposite Melt Compounding," *SAMPE Fall Technical Conference*, Memphis, TN, 09-08-2008.
- P. S. Bhosale, H. A. Stretz, "Gold Nanoparticle Deposition Using CO<sub>2</sub>-Expanded Liquids, Effect of Pressure Oscillation and Surface-Particle Interactions," *Langmuir* 24 (2008) 12241-12246.
- P. S. Bhosale, M. V. Panchagnula, H. A. Stretz, "Mechanically Robust Nanoparticle Stabilized Liquid Marbles," *Applied Physics Letters*, 93 (2008) 034109.
- H. A. Stretz, D. R. Paul, "Properties and Morphology of Nanocomposites Based on Styrenic Polymers: Part II. Effects of Maleic Anhydride Units" *Polymer* 47 (2006) 8527-8535.

DR. DONALD P. VISCO, JR.

PROFESSOR

GRADUATE PROGRAM COORDINATOR AND ASEE CAMPUS REPRESENTATIVE

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## EDUCATION

Ph.D., Chemical Engineering, University at Buffalo, State University of New York, 1999

B.S., Chemical Engineering, University at Buffalo, State University of New York, 1992

## RESEARCH AREAS

In Silico Compound Design

Computational Thermodynamics

Systems-Based Engineering Education

## RESEARCH STATEMENT

The research performed by Dr. Visco can be generally termed “computational modeling for industrial applications.” In particular, Dr. Visco uses computational modeling across a variety of areas of science from complex equation of state development for the refrigerant and blowing agent industry to biodiversity analysis and drug design.

Projects Relevant to the Refrigerant and Blowing Agent Industry – With the Montreal Protocol, production of chlorofluorocarbons (CFCs) were banned and the search for replacement refrigerants (and foam blowing agents) began. Current wisdom indicates that a variety of substances will be used to replace the CFC's, depending on application. Our research in this area focuses on a number of issues relevant to replacing these ozone-depleting substances. In one project we are utilizing the SAFT-VR equation of state to predict mixture properties involving hydrofluorocarbons, hydrofluoroethers and hydrocarbons. By exploring composition space in this manner, we can attempt to control and optimize various system properties (i.e., thermal conductivity, normal boiling point, flammability, etc.) resulting in substances tailored to particular industries. In another project we are exploring the issue of blowing agent solubility in the precursors of polyurethane foam, which is important to create the desired foaming action, using molecular models. Owing to its popularity within the refrigerant industry, we have another project that critically examines the predictive power of SAFT-VR via a systematic study as well as exploring new methods to calculate phase coexistence from equations of state. Finally, as hydrogen fluoride (HF) provides the fluorine ion source in the production of fluorine-containing refrigerants and blowing agents, we are extending our previous modeling work on HF to explore heat effects of HF-mixtures as well as the challenging aqueous-HF system.

Projects Relevant to Biodiversity Analysis and Drug Design – The broad field of structure-property relationships allows researchers in many areas to use such dependencies to correlate properties with particular features of the compounds examined. After this information is gleaned, the next step is to use the results on the relative importance of some features to predict information about compounds that have not been examined in this way. The hope is, of course, that better compounds can be developed in this manner that have optimal desired properties. Unfortunately, the limiting step in the procedure is how to best quantify the particular features of the compound's structure. Recent work in our research group, in collaboration with Sandia National Laboratories, has brought about great strides in this problem through the introduction of a molecular descriptor, called Signature, which quantifies a molecule's 2D structure. One of our research projects focuses on using Signature to assess the biodiversity of a small database (~ 100 HIV-1 protease inhibitors) and a large database (~ 30,000 AIDS anti-viral drugs). A second project examines the use of the Signature molecular descriptor via an inverse quantitative/structure property (I-QSPR) approach to determine new ICAM-1 inhibitory peptides. Additional projects are looking at the I-QSPR approach using Signature for thermophysical properties of refrigerants as well as in the design of novel COX-2 inhibitors.

## RECENT PUBLICATIONS

- B. Baburao and D. P. Visco, Jr., "Association Based Equation of State for Substances Forming Monomers, Dimers and Trimers", *Fluid Phase Equilibria* (accepted – in press).
- B. Baburao, D. P. Visco, Jr. and T. Albu, "Association Patterns in  $(HF)_m(H_2O)_n$  ( $m + n = 2-8$ ) Clusters", *J. Physical Chemistry A*, 111, 7940 – 7956 (2007).
- S. Swaminathan, D. P. Visco, Jr. and S. Sen, "Detection of Shallow Inclusions in Closed-Packed Granular Beds using Mechanical Impulses", *Applied Phys. Lett.*, 90, 154107/1 – 154107/3 (2007)
- B. Baburao and D. P. Visco, Jr., "Isothermal Compressibility Maxima of Hydrogen Fluoride in the Super Critical and Super Heated Vapor Region", *J. Physical Chemistry B*, 110, 26204 – 26210 (2006)
- P. Kannan, J. J. Biernacki and D. P. Visco, Jr., "A Review of Physical and Kinetic Models of Thermal Degradation of Expanded Polystyrene Foam and Their Application to the Lost Foam Casting Process", *J. Analytical and Applied Pyrolysis*, 78, 162 – 171 (2006)

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Searching for electronic journal sources can be done through the **Find -> Magazines and Journal Articles** links in the homepage. The availability of journal articles is limited, with a wider selection being housed as hardcopies in the library. The library does have the option of an Interlibrary Loan, which involves requesting other libraries in the Tennessee Board of Regions (TBR) system for resources. This system provides a much larger selection, however, access to the journal (or textbook) takes up to two weeks. Journals are typically scanned and emailed to the student; textbooks are typically mailed, however, some textbooks are available online (see **Find -> Ebooks**). This service can be accessed through the Services -> Interlibrary Loan links in the homepage. The links will lead to a step-by-step tutorial of the process.

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<http://www.tntech.edu/library/researchGuide/ChE.html>

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