

# Ranjith Kumar Abhinavam Kailasanathan

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## EDUCATION

### Doctor of Philosophy, Mechanical Engineering

North Carolina State University, Raleigh, NC

May 2012

GPA 3.73

- *Dissertation*: "Experimental investigations on ethylene laminar flames at elevated pressures".
- *Committee*: William Roberts, Tiegang Fang, Tarek Echekki, Alexi Saveliev, Jessica Jameson.

### Master of Science, Mechanical Engineering

North Carolina State University, Raleigh, NC

May 2008

GPA 3.67

- *Dissertation*: "Experimental investigation on pulsejet engines".
- *Committee*: William Roberts, Andrei Kuznetsov, Terry Scharton.

### Bachelor of Engineering, Mechanical Engineering

Sathyabama Institute of Science and Technology, India

May 2005

## RESEARCH EXPERIENCE

### *Post-Doctoral Research Associate-West Virginia University, Morgantown, WV*

*March 2013 -Present*

- Design, develop and conduct gas phase and heterogeneous kinetics experiments using optical laser diagnostics pertaining to combustion at low pressures and high temperatures
- Supervise, guide, train and mentor 2 PhD and 2 undergraduate students in respective research projects
- Guest user at the Lawrence Berkeley National Lab - Advanced Light Source (ALS) conducting experiments, using vacuum ultraviolet photoionization and TOFMS, pertaining to combustion

### PROJECTS:

Gas phase kinetics for investigation of elementary combustion reactions

- Developed an apparatus to measure rate constant of OH+Phenylacetylene reaction as a function of temperatures and pressures.
- Employed pulsed laser photolysis and laser induced fluorescence to infer rate constant from consumption rates of reactants.
- Design, conceive and develop experiment to detect radicals on surface of flame generated carbon particles at combustion conditions
- Developed data acquisition and assisted in development of novel catalysts using transition metals for catalytic converters

Product detection of reactions between  $C(^3P)$  + Hydrocarbons

- Conduct research at the synchrotron facility at Lawrence Berkeley National Lab (LBNL) to identify products of reactions involved in combustion reactions
- Confirmation of formation of Propargyl radical, an important soot precursor

### *Research Associate-North Carolina State University, Raleigh, NC*

*January 2009 - May 2012*

- Fulfilled and lead an Army Research Office (ARO) (under guidance of a PI) for emission studies in high pressure laminar diffusion flames
- Designed, developed, fabricated and pioneered an experimental setup for species extraction for flame emission investigation at high pressures up to 16 atm
- Set up gas supply system, high pressure vessel in laboratory adhering to EHS regulations
- Supervised and guided people on Gas chromatography and Mass Spectrometry use
- Met aggressive schedules, deadlines in preparation of reports and presentations

**PROJECTS:**

High pressure combustion chamber prototype for soot formation and emission studies

- Investigated soot precursors and flame temperatures to understand soot formation at elevated pressure and ultimately help reduce emissions from internal combustion engines.
- Developed and designed experiment, extractive sampling setup to sample non-fuel hydrocarbons at elevated pressures up to 16 atmospheres.
- Pioneered experiment to measure polycyclic aromatic hydrocarbons (PAH) at high pressures up to 8 atmospheres.
- Measured permanent gases using a GC-TCD at pressures up to 12 atmospheres.
- Investigated physical and chemical effects of fuel side diluents on soot precursor formation and flame temperature.
- Obtained 2D temperature profile in-flame using thermocouple to understand sooting behavior and reaction zone shape as a function of pressure in diffusion flames.
- Measured soot surface temperature of high pressure laminar diffusion flames with various diluents using 2 Color pyrometry.

***Masters Thesis-North Carolina State University, Raleigh, NC***

*August 2005 - Jan 2008*

Development of novel propulsion technology using pulse jets

- Designed and investigated thrust performance of unsteady thrust augmentor on 50 cm liquid fueled valved pulse jets.
- Analyzed the flow field interaction and entrainment process between the exit of the pulse jet and entry of an unsteady thrust augmentor using Particle Image Velocimetry (PIV).
- Investigated the effects of exhaust flare shape on 50 cm valved pulse jet thrust performance.
- Built a novel pulse jet based on the principle of operation of a Helmholtz Resonator.

**TEACHING EXPERIENCE****Instructor-North Carolina State University, Raleigh, NC**

*January 2010-May 2010*

- Sole instructor for Thermodynamics Spring 2010, enrollment-63, Statics Summer 2009, enrollment-31
- Instructed and managed an undergraduate class, organized syllabus, course material, assignments, tests and assigned grades.

**Teaching Assistant-North Carolina State University, Raleigh, NC**

*August 2006-December 2009*

- Trained undergraduate students in the operation of subsonic and supersonic wind tunnels and related experiments as a lab teaching assistant
- Advised and mentored students on course projects and assignments as a teaching assistant

**Graduate assistant, Lab Support-North Carolina State University, Raleigh, NC**

*January 2006 - May 2006*

- Developed an experiment for the study of flows around a cylinder in a wind tunnel using PIV (Particle Image Velocimetry)
- Implemented a gas analyzer setup to perform  $NO_x$  emission measurements from a gas turbine

**LEADERSHIP EXPERIENCE**

- Project Lead
  - Conceive and lead a project aimed at investigating reactions between carbon particles and hydrocarbons
  - Led a group of 2 in an ARO project and reported to a Principal investigator/advisor
- Team Leader-Orientation team leader at the Office of International Student's Services for 6 consecutive years, organizing extensive multi-cultural programs for more than 800 new international students

## TECHNICAL SKILLS AND CERTIFICATIONS

- Gas Chromatography - Mass spectrometry, Time of Flight Mass Spec, Flame Ionization Detection & Thermal Conductivity Detection
- Laser diagnostics (Class IV Nd:YAG, Excimer) for Laser Induced Fluorescence and Particle Image Velocimetry
- MatLab, Maple, AutoCad, SolidWorks, LabVIEW, IGOR, Microsoft Office (Word, Excel, Powerpoint)
- Certified by NC State University to operate a Transmission Electron Microscope.

## PEER-REVIEWED PUBLICATIONS

1. Ranjith Kumar Abhinavam Kailasanathan, Juddha Thapa, Fabien Goulay (2014). [Kinetic Study of the OH Radical Reaction with Phenylacetylene](#). *Journal of Physical Chemistry. A*, 118(36), 7732–7741.
2. Ranjith Kumar Abhinavam Kailasanathan, Ji Zhang, Tiegang Fang, William L. Roberts (2014). [Effects of diluents on soot surface temperature and volume fraction in diluted ethylene diffusion flames at pressure](#). *Combustion Science and Technology*, 186(6), 815–828.
3. Ranjith Kumar Abhinavam Kailasanathan, Tiffany L.B. Yelverton, Tiegang Fang, William L. Roberts (2013). [Effects of different diluents on species and flame temperature in Diluted Ethylene-Air Laminar Jet Diffusion Flames at Elevated Pressures](#). *Combustion and Flame*, 160(3), 656–670.
4. Ranjith Kumar Abhinavam Kailasanathan, Emily K. Book, Tiegang Fang, William L. Roberts (2013). [Hydrocarbon Species Concentrations in Nitrogen Diluted Ethylene-Air Laminar Jet Diffusion Flames at Elevated Pressures](#). *Proceedings of the Combustion Institute*, 34, 1035–1043.

## CONFERENCE PRESENTATIONS

1. Ranjith Kumar Abhinavam Kailasanathan, Emily K. Book, Tiegang Fang, William L. Roberts, "Hydrocarbon Species Concentrations in Nitrogen Diluted Ethylene-Air Laminar Jet Diffusion Flames at Elevated Pressures", *34th International Symposium on Combustion, Warsaw, Poland (August 2012)*.
2. Ranjith Kumar Abhinavam Kailasanathan and William L. Roberts, "Hydrocarbon Species Concentration Measurements in Diluted Laminar Jet Diffusion Flames at Elevated Pressures", *7th Annual U.S Combustion Meeting, Atlanta GA (March, 2011)*.
3. T. L. B. Yelverton, Ranjith Kumar Abhinavam Kailasanathan and William L. Roberts, "Hydrocarbon species concentration measurements in carbon dioxide diluted laminar jet diffusion flame from 1 to 4 atmospheres", *6th Annual U.S Combustion Meeting, Ann Arbor, MI (May, 2009)*.

## MANUSCRIPTS, POSTERS and TALKS

1. Product detection of  $C(^3P)$  reactions with small unsaturated hydrocarbons, Ranjith Kumar Abhinavam Kailasanathan, Fabien Goulay, Michael Capron, Sebastien R. Le Picard, David L. Osborn, Craig A. Taatjes, *Advanced Light Source - User Meeting: October 6-8, 2014, Berkeley, CA*.
2. Catalytic properties of transition metals in emission control, Julia A. Oliveto, Zachary Decker, Talitha M. Selby, Ranjith Kumar A.K., Mohindar Seehra, Fabien Goulay, *248th ACS National Meeting & Exposition, August 10-14, 2014, San Francisco, CA*.
3. Product detection of  $C(^3P)$  reactions with small unsaturated hydrocarbons, March 2014, Sebastien R. Le Picard, Ranjith Kumar A. K., Michael Capron, Fabien Goulay, *Advanced Light Source Proposal, Lawrence Berkeley National Lab, March 2014*.
4. OH Radical Reaction Kinetics with Aromatic Molecules and Solid Cellulose Surrogates, Fabien Goulay, Juddha Thapa, Ranjith Kumar A.K., H. Fan, Kevin Wilson, *32nd International Symposium on Free Radicals; 21-26 July 2013 Potsdam, Germany*.
5. Experimental investigations on Ethylene Laminar Diffusion flames at elevated pressures, *Physical Chemistry Seminars, May 6th 2013, West Virginia University, USA.*