

Present and Mailing Address:

Dr. Pranab Kumar Kundu
 Mechanical Engineering Department
 NIT Sikkim, South Sikkim 737 139
 Sikkim, India

E-Mail:
 pranabkundu@gmail.com/pranab@nitsikkim.ac.in
 Contact Phone: +91-9433887700



Dr. Pranab Kumar Kundu

Research Interest

My major research interest is in the field of interfacial phenomena. Specifically the area of expertise is in the field of microscale transport involving change of phase heat transfer from micro-devices, characterization and quantification of the forces present in micro-scale systems. I work on the design and development of microscale heat spreaders for cooling of electronic components, which is one of the cutting edge researches in an area of contemporary interest.

Academic Qualifications

Exam/Degree	Institute/University	Year	Specialization	Class/Division
Ph.D (Engg.)	Indian Institute of Technology, Kharagpur, India	2015	Microfabrications & Microfluidics	N.A.
M.E.	Jadavpur University, Kolkata, India	2002	Mechanical Engineering (Production Specialization)	1st Class
B.Tech.	Kalyani Government Engineering College, Kalyani, West Bengal, India. (University of Kalyani)	1999	Mechanical Engineering	1st Class
Higher Secondary (10+2)	WBCHSE	1995	Science	1st Division
Secondary (10)	WBBSE	1993	---	1st Division

Work Experience

12th Aug. 1999 – 7th July 2000

Lecturer

Department of Mechanical Engineering
 Kalyani Government Engineering College, Kalyani, Nadia, W.B.
 Nature of work: Teaching and Lab Development

24th Jan. 2002 – 9th July 2002

Lecturer

Department of Mechanical Engineering
 B. P. Poddar Institute of Management and Technology, Kolkata, W.B.
 Nature of work: Teaching, Research and Lab Development

10th July 2002 – 29th Oct. 2007

Lecturer

Department of Mechanical Engineering
Heritage Institute of Technology, Kolkata, W.B.
Nature of work: Teaching, Research and Lab Development

30th Oct. 2007 – 31st March 2010

Junior Project Officer

Sponsored Research and Industrial Consultancy, IIT Kharagpur

Project title: A Study of Microscale Transport Processes leading to the Development of a Cooling Strategy for Electronic Components

Funded by: Department of Information Technology, Govt. of India
Nature of work: Research and Lab Development

1st April 2010 – 31st May 2011

Senior Project Officer

Sponsored Research and Industrial Consultancy, IIT Kharagpur

Project title: A Study of Microscale Transport Processes leading to the Development of a Cooling Strategy for Electronic Components

Funded by: Department of Information Technology, Govt. of India
Nature of work: Research and Lab Development

1st Oct. 2011 – 31st Jan. 2015

Senior Research Fellow

Sponsored Research and Industrial Consultancy, IIT Kharagpur

Project title: A Study of Microscale Transport Processes leading to the Development of a Cooling Strategy for Electronic Components

Funded by: Indian Space Research Organization, Govt. of India
Nature of work: Research and Lab Development

1st Feb. 2015 – 17th Jan. 2016

Research Associate

Sponsored Research and Industrial Consultancy, IIT Kharagpur

Project title: A Study of Microscale Transport Processes leading to the Development of a Cooling Strategy for Electronic Components

Funded by: Indian Space Research Organization, Govt. of India
Nature of work: Research and Lab Development

18th Jan. 2016 – Till date

Assistant Professor

Department of Mechanical Engineering
National Institute of Technology Sikkim, Ravangla, South Sikkim,
Nature of work: Teaching, Research and Lab Development

Administrative Experience

July 2005-Oct. 2007

Chairman, Sports Committee

Organization: Heritage Institute of Technology, Kolkata, W.B.

Nature of Responsibility: Organizing all kinds of sports activities of the

students including Annual Sports, Inter College Sports, etc.

February 2016-till date

Faculty In-charge of Games, Sports & Cultural Activities

Organization: National Institute of Technology Sikkim, South Sikkim,
Nature of Responsibility: Organizing all kinds of sports and cultural activities of the students including Annual Sports, Inter NIT Sports meets, Annual cultural fest, Annual Technological fest, etc.

Awards and Recognitions

- National scholarship scheme merit certificate (for higher secondary result), West Bengal Govt. Education department, 1995.
- Qualified GATE 2000.
- Institute Fellowship Autumn Semester 2006 – 2007 in the Department of Mechanical Engineering of IIT Kharagpur.
- Institute Fellowship Autumn Semester 2006 – 2007 in the Department of Aerospace Engineering of IIT Kharagpur.

Membership of society/position held in society

- (i) Associate Member of Institute of Engineers (I); Membership no. AM093567-3.
- (ii) Life Member of Association of Engineers (I); Membership no. LM-350.

Thesis

- Ph. D.** Fabrication and Performance Evaluation of On-Chip Micro Heat Pipe[†]
- M.E.** Computational Modelling of Heat and Mass transfer in Laser Surface Melting
- B.Tech.** On Grinding Wheel Performance Through Modified Grinding Fluid Application

[†] Please see the annexure for a brief summary of doctoral research work

Details of Foreign Visit

Research Visit

University of California, Irvine, CA, USA (June – July 2009).

Publications

Books

- S. Sarkar and P. K. Kundu, “*Engineering Mechanics*”, Matrix Educare Pvt. Ltd., 2012, Kolkata – 6, India, ISBN 978-93-80221-01-4
- S. Sarkar and P. K. Kundu, “*Engineering Thermodynamics and Fluid Mechanics*”, Matrix Educare Pvt. Ltd., 2012, Kolkata – 6, India, ISBN 978-93-80221-21-2
- S. Sarkar and P. K. Kundu, “*Thermal Power Engineering*”, Matrix Educare Pvt. Ltd., 2012, Kolkata – 6, India, ISBN 978-93-80221-45-8

International Journal

P. K. Kundu, S. Chakraborty, S. DasGupta, “**Experimental Investigation of Enhanced Spreading and Cooling from a Micro-grooved Surface**”, *Microfluidics and Nanofluidics*, 2011, Volume 11, Number 4, 489-499, DOI: 10.1007/s10404-011-0814-5

P. K. Kundu, S. Mondal, S. Chakraborty, S. DasGupta, “**Experimental and Theoretical Evaluation of On-Chip Micro Heat Pipe**”, *Nanoscale and Microscale Thermophysical Engineering*, 2015, Volume 19, Issue 1, pp 75-93, DOI:10.1080/15567265.2014.1003342

P. K. Mondal, H. Gaikwad, P. K. Kundu, S. Wongwises, “**Effect of thermal asymmetries on the entropy generation analysis of a variable viscosity Couette–Poiseuille flow**”, Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, OnlineFirst, <https://doi.org/10.1177/0954408916688234>

International Conference

P. K. Kundu, S. Das, S. Sinha, P. P. Chowdhury, “**On Grinding Wheel Performance in Dry and Wet Conditions**” – Proc. 4th Int. Conf. On Mech. Engg., Dec.26-28, 2001, Mech. Engg. Dept., BUET, Dhaka, Bangladesh, Vol. IV, Sec. V, pp. 19-24.

P. K. Kundu, S. P. Chaudhuri, S. Chakraborty, “**Computational Modelling of Heat Transfer and Mass Transfer in Laser Surface Melting**” – Proc. 4th Workshop on Application of Laser in Mechanical Industry (WALMI), Feb.22-24, 2002, Dept. of Mech. Engg., Jadavpur University, Kolkata.

P. K. Kundu, S. P. Chaudhuri, S. Chakraborty, “**Cutting of Mild Steel Specimens in CO2 Laser**” - Proc. Int. Conf. On Manufacturing, Aug.9-11, 2002, Industrial & Production Engg. Dept., BUET, Dhaka, Bangladesh, Vol. I, pp. 519-526.

National Conference

P. K. Kundu, S. P. Chaudhuri, S. Chakraborty, “**Study on Temperature During Cutting of Low Carbon Steel Specimens in CO2 Laser**” – Proc. 20th AIMTDR Conf., Dec.13-15, 2002, Dept. of Prod. Engg., BIT Mesra, Ranchi, pp. 349-354.

P. K. Kundu, T. Das, A. Mohapatra, S. DasGupta, S. Chakraborty, “**Initiation of Super Hydrophobic Silicon Surface Using Electrostatic Self-Assembly**”, CHEMCON, Dec. 27-29, 2011, Bengaluru, India

T. Das, P. K. Kundu, S. DasGupta, S. Chakraborty, “**Analysis of Fluid Flow and Heat Transfer in Triangular Microgrooves**”, ChemBridge Conference Proceedings, Kolkata, 2012.

M. Mukhopadhyay, P. K. Kundu, “**Laser Assisted Conditioning of Aluminium Oxide Grinding Wheel using Nd:YAG Laser: A Review**”, Proc. National Conference on Advanced Functional Materials Processing & Manufacturing, Feb. 2-3, 2017, CMERI Durgapur, pp. 63-66.

Product Development

An On-chip Micro Heat Pipe

Special Skill-set

Microfabrications, Experimental Microfluidics, Transport Phenomena, Ellipsometry, AutoCAD, Grinding, Non Traditional Machining Processes

List of Course/Training Completed

Title of the course	Nature of the course/workshop	Sponsoring/ Funding agency	Duration Of the course	Host /organizing institute
1 HRD Programme	Training	AICTE	October 13-16, 2004	Indian Heritage Academy and Heritage Institute of Technology
2 Recent advances in hydraulic control systems	Refresher course	UGC	June 20- July 9, 2005	Jadavpur University
3 Mechatronics, robotics & industrial automation	Short term course	TEQIP	January 2-7, 2006	Bengal Engineering & Science University, Shibpur
4 Special topics in fluid mechanics	Refresher course	UGC	January 1-21, 2007	Jadavpur University
5 Fundamental training on spectroscopic ellipsometry (basic+advanced)	Training	Ja Woollam co. Inc.	January 22-25, 2012	University of Mumbai and National Chemical Lab, Pune

List of Workshop/Training Program/Summer/Winter School Attended

1. **Int. Conf. On Mechanical Engineering**, BUET, Dhaka, Bangladesh, Dec. 26-28, 2001.
2. **16th National and 5th International ISHMT-ASME Heat and Mass Transfer Conference**, Jointly organized by Jadavpur University and B.E College (DU), Science City, Kolkata, Jan. 11-13, 2002.
3. **4th Workshop on Application of Laser in Mechanical Industry**, Jadavpur University, Kolkata, Feb. 22-24, 2002.
4. **Int. Conf. On Manufacturing**, BUET, Dhaka, Bangladesh, Aug. 9-11, 2002.
5. **20th AIMTDR Conference**, BIT, Mesra, Ranchi, Dec. 13-15, 2002.
6. **Conference on Advances and Recent Trends in Manufacturing (CARTM)**, Kalyani Government Engineering College, Kalyani, Nadia, November 14-15, 2003.
7. **5th Workshop on Application of Laser in Mechanical Industry**, Jadavpur University, Kolkata, Feb. 27-29, 2004.
8. **All India Workshop on Advances in Welding Science & Technology**, Bengal Engineering & Science University, July 22-23, 2005.

9. **Current Advances in Productivity Management**, Department of Production Engineering, Jadavpur University, July 25, 2005.
10. **International workshop on Engineering Fundamentals and Applications of Fuel cells**, Mechanical Engineering., Jadavpur University, January 9-10, 2008.
11. **Mechanics Over Micro and Nano Scales**, Bengal Engineering and Science University, Shibpur, December 21-22, 2009.
12. **Indo-US workshop on Fabronics: The Science of Advanced Fabrication**, Jawaharlal Nehru Engineering College, Aurangabad, Dec 20-21, 2010.
13. **Fabronics: Micro and Nano Scale Dynamics**, Bengal Engineering and Science University, Shibpur, August 18-19, 2012.
14. **22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference**, organized by Indian Institute of Technology Kharagpur, Kharagpur, Dec. 28-31, 2013.
15. **National Conference on Advanced Functional Materials Processing & Manufacturing**, CMERI Durgapur, Feb. 2-3, 2017.

Educational resources and training programs

Delivered MATLAB training programs under the banner of Focus R&D (a company incubated at IIT Kharagpur) to participants from both industry and academia. Notable being the training programs organized at College of Engineering and Management, Kolaghat.

Personal Information

Father's Name	: Rasamoy Kundu
Date of Birth	: 11 th Day of January 1978
Permanent Address	: Andal More, Ukhra Road, Andal, Burdwan, WB, PIN 713321
Marital status	: Married
Nationality	: Indian
Cast	: General

References

Dr. Suman Chakraborty
 Professor, Department of Mechanical Engineering,
 Indian Institute of Technology Kharagpur
 Kharagpur-721302, India
 Ph: +91-3222 282990
 FAX: +91-3222 282278
 Mob: +91-9831402939
 Email: suman@mech.iitkgp.ernet.in

Dr. Sunando DasGupta
 Professor, Department of Chemical Engineering
 Indian Institute of Technology Kharagpur
 Kharagpur-721302, India
 Ph: +91-3222 282037 (O), 283923 (R)
 FAX: +91-3222 282250

Mob: +91-9434020641
Email: sunando@che.iitkgp.ernet.in

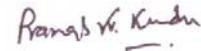
Dr. Santanu Das

Professor, Department of Mechanical Engineering
Kalyani Government Engineering College
Kalyani, Nadia, India, PIN-741235
Ph: +91-33 25827738 (R), 25826680 (O)
FAX: +91-33 25821309
Mob: +91-9433956050
Email: sdas_me@rediffmail.com

Declaration

I do hereby declare that the information furnished above are true and complete to the best of my knowledge and belief.

Date : 9.05.2017
Place : NIT Sikkim



Pranab Kumar Kundu

ANNEXURE: A BRIEF SUMMARY OF DOCTORAL RESEARCH WORK

My PhD topic is “FABRICATION AND PERFORMANCE EVALUATION OF ON-CHIP MICRO HEAT PIPE”. The objectives of my PhD work are the design and fabrication of on-chip micro heat pipes using microchannels etched on the unused side of the semiconductor devices, followed by their characterization and performance analysis as the thermal performance of the micro heat pipe can be significantly enhanced by integrating it with the electronic component itself, leading to *on-chip micro heat pipes*, which are compact yet efficient. One of the primary contributions during PhD has been to develop an in-house facility for fabrication of on-chip micro heat pipe, which has led to the development of a laboratory scale facility unique of this kind. The wide gamut of activities includes design, fabrication, integration, experimentation and subsequent analysis.

Microchannels of different shapes and orientation are etched on double sided polished silicon wafer using standard lithography process (both wet etching and reactive ion etching) with masks designed specifically in AutoCAD 2007 and developed within a precision of 1 μm . Heat shock resistant Pyrex 7740 glass is used to cover the top of the micro channels with specially made connections for vacuum connection and coolant entry. The system is evacuated to a pressure of less than 6 mTorr for a period of 24 hours and then charged with a small amount (0.3 ml) of de-ionized water followed by thermal sealing to form the **on-chip micro heat pipe**. Additionally, the grooves and surfaces are characterized using atomic force and scanning electron microscopy.

In the microscopic analysis of spreading and cooling, a heat transfer cell is specifically designed and the shapes of the liquid menisci in the V-shaped microgrooves are accurately measured using image analyzing interferometry as functions of heat input. The relevant parameters e.g., the adsorbed film thickness, contact angle and curvature at the thicker end of the meniscus are accurately measured and used to explain the physics of the process. The temperature profiles are measured for the microgrooved and non-grooved silicon substrates under identical conditions of heat input and inclination. The axially averaged values of a dimensionless temperature are used to quantify the enhanced cooling and temperature homogenization potentials of microgrooved surfaces.

The performance and the cooling potential of the on-chip micro heat pipes are quantified by accurately measuring the temperature distributions along the channel length. The capillary suction capability of the fabricated micro heat pipe is evaluated by a mathematical model taking into account the capillary pressure driven flow in an evaporating curved microfilm as functions of temperature profile, groove geometry, thermo-physical properties, and contact angle. The numerical solutions of the governing equations provide additional insights into the complex process of flow and enhanced heat transfer in a micro heat pipe. The results establish that the fabricated on-chip micro heat pipes are efficient heat spreaders and are operating within the capillary limit without the occurrence of dry-out.