



Indian Institute of Technology Guwahati
भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
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चिंतन

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IIT Guwahati Researchers Report Advanced Techniques for Rapid Evaporation of Droplet

Researchers from the Indian Institute of Technology Guwahati, India have developed a novel method of controlling the life-time of droplets containing suspended nanoparticles. The suspended nanoparticles are magnetically active, thereby enabling the flexibility of being under control in a magnetic forcing environment.

With the advent of miniaturization, effective transfer of mass between species has attracted significant attention of global communities because of its wide range of industrial applicability. In particular, rapid evaporation and mixing between droplets has extensive range of engineering applications such as biological sample diagnostics, ink-jet printing, surface patterning and many more.

The research is carried out by Dr. Pranab Kumar Mondal, Assistant Professor, Department of Mechanical Engineering, IIT Guwahati, and his Ph.D. scholar, Mr. Sudip Shyam, in collaboration with Dr. Balkrishna Mehta, (Presently at Department of Mechanical Engineering, IIT Bhilai), for exploring the species transport between droplets. The research revealed

that the mixing between two droplets can be attenuated significantly under the actuation of magnetic field. This novel method showed a significant enhancement of around 80% in the overall mixing time between the droplets in comparison to the case where no external force is applied. The research outcomes could be potentially beneficial in the area of biomedical diagnostics, whereby rapid and efficient mixing between fluids is of utmost importance.

In addition to that, this research also revealed that the magnetic field can be successfully used in altering the lifetime of a droplet containing suspended magnetic nanoparticles. The research has shown that the evaporation rate of the droplet can be successfully controlled by varying the applied magnetic field frequency. The inferences drawn from this study could have far-reaching implications ranging from biomedical engineering to surface patterning. The results of this work have recently been published in "SOFT MATTER" a highly reputed journal belonging to the Royal Society of Chemistry (<https://pubs.rsc.org/en/content/articlelanding/2020/sm/d0sm00345j#!divAbstract>).

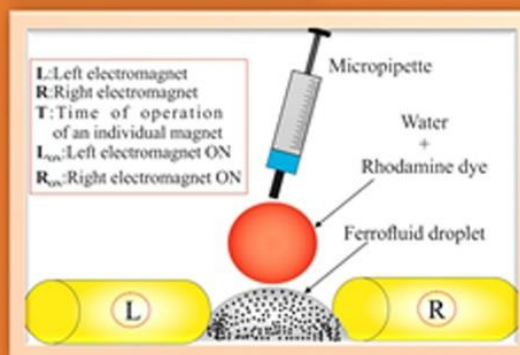
The article has been selected for the themed collection of “SOFT MATTER MOST POPULAR 2020” (<https://pubs.rsc.org/en/journals/articlecollectionlanding?sercode=sm&themeid=576a0cbe-e46f-4a38-add5-08a34bd891ef>).



Dr. Pranab Kumar Mondal, Assistant Professor,
Department of Mechanical Engineering, IIT Guwahati
Mr. Sudip Shyam, PhD Scholar, IIT Guwahati



Dr. Balkrishna Mehta, Assistant Professor,
Currently in Department of Mechanical
Engineering, IIT Bhubilai



Research mixing photo

Team Photo and research photo

Awards and honours



Prof. Subhendu Sekhar Bag, Department of Chemistry, IIT Guwahati has been awarded the prestigious Chartered Chemist designation by the Royal Society of Chemistry, London. This honour is awarded to the scientists who have demonstrated extraordinary research and academic achievements.

The award recognizes Prof. Bag's commendable and outstanding contributions in the field of "Expansion of the Genetic Alphabet/Genetic Code" and "Just-Mix-&-Read Strategy" for SNPs Genotyping toward personalized medicine.



Prof. Tamal Banerjee, Professor, Dept. of Chemical Engineering IIT Guwahati became a Fellow of the Royal Society of Chemistry (FRSC)



Dr. Uttam Manna, Department of Chemistry and Center for Nanotechnology, IIT Guwahati received the certificate of Fellowship from Indian Chemical Society.



Prof. Biman B. Mandal, Department of Biosciences & Bioengineering and Center for Nanotechnology, IIT Guwahati has been selected for "S Ramachandran-National Bioscience Award for Career Development 2020-21". On the occasion of 35th Foundation Day of The Department of Biotechnology, Ministry of S&T, Hon'ble Minister of S&T, MoH&FW and MoES GoI, Dr. Dr Harsh Vardhan will be presenting the awards on 26th Feb 21.

National Bioscience Awards for Career Development are conferred in recognition of outstanding contributions of scientists below 45 years of age who are engaged in basic and applied research in Biological Sciences including Biotechnology, Agricultural, Medical, Environmental Sciences and other related areas. The award recognizes the significant contributions made by scientists in their respective domain research areas with potential for product and technology development.



Mr. Ankush Kumar



Mr. Abhinay Kumar



Mr. Santanu Pathak

Congratulations

The paper titled
Night Visibility: A Major Challenge for Road Users and Innovative Solutions,
authored by
Mr. Ankush Kumar, Mr. Abhinay Kumar and Mr. Santanu Pathak
PhD students from Department of Civil Engineering
won the First Prize in Paper presentation Competition on Road Safety organized by The General Insurance Council



The paper titled "Night Visibility: A Major Challenge for Road Users and Innovative Solutions", authored by Mr. Ankush Kumar, Mr. Abhinay Kumar & Mr. Santanu Pathak PhD studnets form Department of Civil Engineering, IIT Guwahati won the First Prize in Paper Presentation Competition on Road Safety organized by The General Insurance Council.

IIT Guwahati Scientists report energy-efficient and eco-friendly 'Porous Radiant Burner' technology as an alternative to existing burners in the cooking domain

Researchers from the Indian Institute of Technology Guwahati, India, led by Prof. P. Muthukumar, have developed a technology that makes cookstoves energy-efficient, economical and eco-friendly. Burners used in these cookstoves are based on Porous Medium Combustion (PMC) technology, capable of exhibiting enhanced combustion characteristics.

Sustained use of clean cooking energy is influenced by multiple factors like the accessibility of the fuel, affordability of the recurring cost of the fuel, consumer awareness of the adverse health impacts, etc. Therefore, clean cooking energy solutions must be appraised from a multidimensional lens. One of the important aspects of cooking energy solutions is the development of efficient and eco-friendly cookstoves. Over the years, significant research has been devoted for achieving this goal. However, these improved cookstove's impacts are limited due to the inherent disadvantage of combustion technology.

Towards this goal, Dr. P. Muthukumar, Professor, from IIT Guwahati, along with his research team has developed Porous Radiant Burners (PRBs) for various cookstoves with advanced combustion technology known as Porous Media Combustion. The Project is financed through IMPRINT, a technology development initiative of MHRD and DST, Government of India.

Speaking about the merits of their 'cookstoves', Prof. P. Muthukumar said, "These indigenously developed cookstoves are assisted with specially-designed PRBs that yield better performance as compared to their conventional counterparts at all three fronts of energy-saving, emissions and overall cost." The findings of these developments have been published in highly reputed journals²⁻⁵ and also patented. The newly developed PRBs can be effectively used for fuels like LPG, Biogas and Kerosene for domestic as well as community/commercial cooking.






Speaking about the working of their 'cookstoves', Prof. P. Muthukumar said, "These PRBs operate on the principle of Porous Media Combustion (PMC), where the reaction is entrapped in a porous matrix due to which, the heat loss to the surroundings is restricted and a higher amount of heat is transferred to the load". The prototypes needed for the invention have been developed in-house and are rigorously tested against available BIS standards for cookstoves. Fuel saving from these cookstoves is highly promising (See Table: Cookstoves and their performance).

The research team plans to commercialize the technology within one year and corroborate with industrial partners to extend the reach of these cookstoves in the Indian market. The research team believes that the work will have a global impact on the burner-based applications and their multi-billion-dollar market worldwide.

Clean Cooking energy access has been widely recognized as a critical input for sustainable development. Having access to reliable, clean and modern cooking energy improves the standard of living. The provision of clean cooking energy also addresses concerns related to food security, climate change and health care, among others, because of which it has become a goal in its own right. Because of its importance, many programs are undertaken by both governmental and non-governmental organizations all over the world.

The large consumer base in India makes cooking an energy-intensive sector and an efficient cookstove would significantly reduce the fuel needs on a large scale. A recently published article¹ in the Lancet Planetary Health Journal reported that household pollution led to 0.65 M deaths which amount to 6.5% of the total deaths in India. Similarly, household air pollution is also responsible for 4.5% of the total disease burden (measured as Disability-adjusted life-years (DALYs)). These deaths and morbidity eventually add up to huge monetary losses that further add to the economic burden of the country. Household air pollution is caused mainly by the use of polluting cooking fuels and inefficient cookstoves. The Government of India has made efforts to enhance access to clean cooking energy by promoting LPG, biogas and improved cookstoves (ICS) through various policies and programs.

Table: Cookstoves and their performance

Domestic cooking	
 LPG	Burner rating: 1-3 kW Fuel-saving > 25%; Emissions reduction (CO and NO _x) > 80%;
 Biogas	Burner rating: 2-2.7 kW Fuel-saving > 20%; Emissions reduction (CO > 81% and NO _x > 85%)
 Kerosene	Burner rating: 1.5-3 kW Fuel-saving > 11%; Emissions reduction (CO > 70% and NO _x > 88%)
Community/ commercial cooking (LPG)	
 Burner rating: 5-7 kW Fuel-saving ~ > 45%; Emissions reduction (CO and NO _x) > 89%	 Burner rating: 12.56 kW Fuel-saving: 40%; Emissions, CO: 50 ppm, NO _x : 8 ppm

Cookstoves and their performance Picture




Prof F. Muthukumar
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Dept of Mechanical Engineering
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Prof. IIT Guwahati


Mr. Anon Kumar Mahalingam
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Ms. Pratiksha Bora
Research Scholar
IIT Guwahati

IIT Guwahati Scientists report energy-efficient and eco-friendly 'Porous Radiant Burner' technology as an alternative to existing burners in the cooking domain

IIT Guwahati Research Team Picture



IIT Guwahati Professor develops solar light powered bags



Children with the jugnu backpack

Prof Charu Monga calls these bags Jugnu (firefly). She has designed over 200 backpacks, each fitted with solar panels connected to a circular LED light, for children in hilly, remote and un electrified parts of the nation. These bags are made from recycled plastic, they are waterproof and the light integrated into them retains power for several hours. The Jugnu backpack helps children from the Northeast travel along the hilly terrain, walk on dangerous and high altitude roads while returning home and even study or play after sunset in areas where there is no electricity at all or with infrequent power supply.



"The idea began in 2014 when I travelled for workshops with students in the village communities in the Northeast to understand their needs and then develop a solution around it. They shared how they have early sunsets and due to the lack of electricity, they often return home in the dark or meet their friends in the evening when there is no light. The idea of these backpacks came up then as it was not possible to get lights set up in every street corner. We made a tiny detachable pocket in the bag, even if kids play and

roll around in the ground, jump or run, it won't fall off. We kept in mind to keep the colours bright so that people can identify others at night. Whenever exposed to sunlight, the LED light charges itself and can be used anytime," explains Prof. Monga, who is a professor in the Department of Design and Visual Communication.



The name Jugnu wasn't planned at all, adds Prof. Monga. "When I gave the backpack to one of the kids, he said that he looked like a jugnu (Hindi for firefly). That's how we decided on the name," she says. The bag also comes with a tiny lab kit for kids to come up with their own innovations. "I wanted children to experience creativity and innovation early on in life. This way, they can provide solutions to their own communities in the future. Our lab kits consist of DIY material, VR headsets, team building material, educational games and more. We keep evolving the kits but they are mostly related to STEM, design and innovation education," she shares.



Prof. Monga conducts workshops in and around Guwahati with children to help them develop an innovative mindset. Prof. Monga believes that every child should be given an opportunity to contribute their best to humanity. The IIT-G professor and one of her colleagues have also come up with small innovation hubs in and around Guwahati to enable local youth

to have space where they can brainstorm and create new things. "These hubs connect local youth and communities with global experts. We conduct regular sessions and workshops and if anyone has an idea, they can come here and develop it," she adds. Prof. Monga hopes to do similar work in Himachal Pradesh in the near future.

IIT Guwahati hails Budget announcements on higher education, start-ups

The Indian Institute of Technology Guwahati welcomes the Union Budget announcements on higher education, international collaborations, clean energy, healthcare sector and start-up initiatives.

"The setting up of a Higher Education Commission for the accreditation and regular funding of colleges and universities for having better synergy is a great initiative to enhance cooperation among the academic institutes and provide access to every deserving student to have the best possible education tools," said Prof. T. G Sitharam, Director.

"Further, the outlay of Rs 50,000 crore over five years announced for the National Research Foundation will boost research and development. Maintenance of a research ecosystem through international collaborations, especially the tie-up with Japan for sharing of technology and knowledge, will allow India to progress in multidisciplinary areas rapidly", Prof. Sitharam said.

"The core strength of IIT Guwahati lies in quality higher education and research and development. The faculty members have risen to the occasion during the pandemic, and the institute delivered several COVID-19 related products in a very short time," he said.

The Union Finance Minister had also announced the Hydrogen Energy Mission in the Budget for generating hydrogen out of green-powered sources to give a further boost to the non-conventional energy sector and proposed to provide an additional capital infusion of Rs 1,000 crore to the Solar Energy Corporation of India and Rs 1,500 crore to the Indian Renewable Energy Development Agency.

"Several faculty members of IIT-G have been making valuable contributions to these areas, and these announcements will provide a thrust to the national

drive for clean and renewable energy devices and technology”, added Prof. Sitharam.

He also stated that the investment promise of over Rs 3,000 crore for re-aligning the National Apprenticeship Training Scheme would help in providing trained staff to the industry sector.

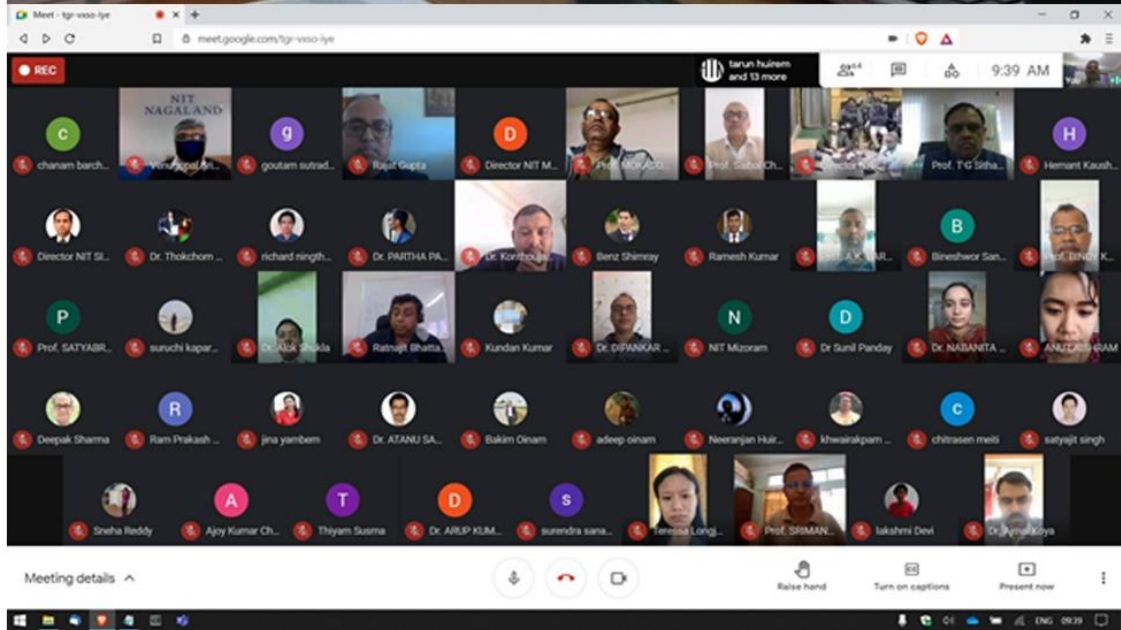
“The efforts of IIT Guwahati are also likely to benefit from the announcement on the start-ups and innovation initiatives. The Research Park at IITG has already been actively promoting start-ups from alumni, students, faculty and entrepreneurs, and this initiative will surely boost our efforts,” he said.

The hike in allocation to the health sector by whopping 137 per cent is a welcome move as well, he added.



IIT Guwahati has been at the forefront in the fight against Covid, from designing and developing innovation to fight against Covid, to providing infrastructural and other necessary support to the Government.

IIT Guwahati was recently felicitated by the Department of Health & Family Welfare, Govt. of Assam for the valuable contributions in the fight against Covid-19. Hon'ble Minister Dr. Himanta Biswa Sarma gave away the awards at the GMCH Auditorium.



Inauguration of the Workshop for NER NIT faculty members on "Online Teaching, Virtual Labs and Job-Placements" organised by Indian Institute of Technology Guwahati in collaboration with NIT Mizoram.



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