Preface

S. R. Chakravarthy · T. N. C. Anand

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It is with great pleasure that we bring out the twin Special Issues on *Combustion* in the *International Journal of Advances in Engineering Sciences and Applied Mathematics (AEAM)*.

The Special Issues on *Combustion* couldn't come out at a more appropriate time. In the last decade, combustion is an area that has been perceived to be at a crossroads. While the benefits of combustion in the advancement of the human civilization particularly in modern times needs no elaboration, the hazards of pollutant emissions from combustion of fossil fuels began to gain attention towards increased research in the last 2–3 decades. Further, in the last decade, the emission of not only pollutants at ppm levels but also large-scale release of greenhouse gases such as carbon dioxide by combustion of hydrocarbon fuels leading to human-made global warming and climate change has called into question the very basis and sustainability of a combustion-based modern civilization. In the mean time, the uncertainty over the long term availability of crude oil and the need for cheaper fuel alternatives in highly populated emerging economies has had researchers and industry explore several alternative fuels, partly also motivated by the need to avoid the environmental problems associated with conventional fossil fuels. Thus, the twin challenges of environment and energy have been reshaping combustion research in this decade. The world is poised at a critical juncture now, and course corrections on lifestyle practices in the use of energy and their impact on the environment are expected to be effected by intense research on combustion in coming years. The research approach has been getting increasingly specialized

through heavy-duty diagnostic techniques and extremely high fidelity computational simulations.

In view of the above trend, it is not surprising, therefore, that several centres on combustion research have been set up in recent years all over the world involving critical mass of researchers gravitating towards them. Notable ones are the research centres at Princeton University (USA), University of Lund (Sweden), Tsing'hua University (China), and the recently established Clean Combustion Research Centre (CCRC) at the King Abdullah University of Science and Technology (Saudi Arabia). In India, the Central Government has supported the setting up of the National Centre for Combustion Research and Development (NCCRD) at the Indian Institute of Technology Madras (IIT Madras), Chennai, and the Indian Institute of Science (IISc), Bangalore, in the last 3 years. These two institutions have been identified based on a critical mass of combustion researchers present therein, namely, 29 faculty members at IIT Madras across 6 departments and 17 faculty members at IISc. This is partly reflected in the present Special Issues, as will be noted below.

Combustion research is motivated by applications not only in energy and environment, but also in transportation, propulsion, fire research, new concepts and technologies, and towards fundamental understanding of the science. The present Special Issues reflect the breadth of these aspects in full measure. In all, ten full-length articles have been successfully processed through the review cycle towards acceptance in the Special Issues. Of these, two articles pertain to internal combustion engines of the automotive type: Chintala and Subramanian present experiments on the effect of premixing of charge in a Diesel engine, while Brijesh et al. present computational studies on the effect of various parameters on Diesel engine performance. Two articles relate to combustion and gasification of coal as in

S. R. Chakravarthy (✉) · T. N. C. Anand
IIT Madras, Chennai, India
e-mail: src@ae.iitm.ac.in

thermal power applications: Jayaraman and Gokalp's study on high-ash coals discusses about the pyrolysis, gasification and combustion behavior of these coals, while Balakrishnan and Nagarajan present a model which can predict whether fly ash sticks to a surface or bounces off based on the roughness of the surface, and surface energy of the splat. Aerospace combustion is also well represented: the detailed numerical investigation by Aggarwal et al. discusses the ignition characteristics of two JP-8 surrogates when assisted by hydrogen and syngas. The authors observe that their model represents the qualitative ignition characteristics of a wide range of commonly used fuels. Minamoto and Swaminathan performed DNS studies to evaluate the performance of models, which can predict the novel concept of MILD combustion satisfactorily, and provide recommendations on models, which can be used. Ishitha and Ramakrishna present an explanation for the modification of burn rate of solid propellants with activated charcoal, based on experimental observations. An understanding of the combustion mechanism will enable tailoring a propellant composition with high and near constant burn rates. Fundamental studies are also presented in this issue: The paper by Paul and Datta experimentally studies structural changes in the soot precursor particles during the soot formation process. They observe that different regions of the flame have different types of compounds. Fire suppression and prediction are important areas, which do not receive as much attention in literature as other areas of combustion. Ali and Raghavan present a numerical study on the combustion of pool flames with a co-flow. Combustion diagnostics is an important area as well, and Sulochana et al. present a development of a super

luminescent diode based sensing technique, which can measure methane and carbon dioxide concentrations. With the emphasis on alternate fuels such as biogas, their study addresses an application, which will become increasingly important. There is a good mix of approaches reported in these articles in terms of experimental and computational work that should motivate the reader to refer to them in further work. The submissions have originated from the USA, UK, and France, and within India, from IIT Bombay, IIT Delhi, Jadavpur University and IIT Madras. The preponderance of articles from the last institution is due to a rather large presence of combustion researchers there as already noted above.

All articles were submitted based on invitation to the Special Issue, and have undergone review by a minimum of two reviewers, and multiple rounds of revisions in some cases, following international standards. At the end of the review cycle on all these articles, it is a matter of great satisfaction for us to be able to bring them out in the Special Issues. We have been delighted by the response of the authors in contributing to the Special Issues, and we profusely thank the reviewers in doing an assiduous and timely job going through the manuscripts, more than once in some cases. We sincerely hope that the professionalism of the international combustion research community is well reflected through these Special Issues.

Finally, we thank the Editor-in-Chief for identifying the area of combustion for the Special Issue at Int. J. AEAM and for giving us the opportunity to serve as the Guest Editors. We also thank the journal office staff for their cooperation and timely interventions in keeping the review cycle on all the articles on track.