

Preface

Energy demand has been rising remarkably due to increasing population and urbanization. Global economy and society are significantly dependent on the energy availability because it touches every facet of human life and its activities. Transportation and power generation are major examples of energy. Without the transportation by millions of personalized and mass transport vehicles and availability of 24×7 power, human civilization would not have reached contemporary living standards.

The first international conference on ‘Sustainable Energy and Environmental Challenges’ (SEEC-2017) was organized under the auspices of ‘International Society for Energy and Environmental Sustainability’ (ISEES) by the ‘Center of Innovative and Applied Bioprocessing’ (CIAB), Mohali, from 26 to 28 February 2017. ISEES was founded at IIT Kanpur in January 2014 with an aim of spreading knowledge in the fields of energy, environment, sustainability and combustion. The society’s goal is to contribute to the development of clean, affordable and secure energy resources and a sustainable environment for the society and to spread knowledge in the above-mentioned areas and awareness about the environmental challenges, which the world is facing today. ISEES is involved in various activities such as conducting workshops, seminars, conferences in the domains of its interest. The society also recognizes the outstanding work done by the young scientists and engineers for their contributions in these fields by conferring those awards under various categories.

This conference provided a platform for discussions between eminent scientists and engineers from various countries including India, USA, South Korea, Norway, Malaysia and Australia. In this conference, eminent speakers from all over the world presented their views relating to different aspects of energy, combustion, emissions and alternative energy resource for sustainable development and clean environment through accurate monitoring and control. The conference started with four mini-symposiums on very topical themes, which included (i) New Fuels and Advanced Engine Combustion, (ii) Sustainable Energy, (iii) Experimental and Numerical Combustion and (iv) Environmental Remediation and Rail Road Transport. The conference had 14 technical sessions of topics related to energy and

environmental sustainability and a panel discussion on 'Challenges, Opportunities and Directions of Technical Education and Research in the Area of Energy, Environment and Sustainability' to wrap up the three-day technical extravaganza. The conference included 2 plenary talks, 12 keynote talks, 42 invited talks from prominent scientists, 49 contributed talks and 120 posters. A total of 234 participants and speakers attended this three-day conference, which hosted Dr. V. K. Saraswat, Member, NITI Aayog, India, as a chief guest for the award ceremony of ISEES. This conference laid out the road map for technology development, opportunities and challenges in this technology domain. The technical sessions in the conference included Advances in IC Engines and Fuels; Conversion of Biomass to Biofuels; Combustion Processes; Renewable Energy: Prospects and Technologies; Waste to Wealth—Chemicals and Fuels; Energy Conversion Systems; Numerical Simulation of Combustion Processes; Alternate Fuels for IC Engines; Sprays and Heterogeneous Combustion of Coal/Biomass; Biomass Conversion to Fuels and Chemicals—Thermochemical Processes; Utilization of Biofuels; and Environmental Protection and Health Through Sensory Systems for Monitoring and Control. All these topics have been very relevant for our country and the world in the present context. The society is grateful to Prof. Ashok Pandey for organizing and hosting this conference, which led to the germination of this series of monographs, which included 16 books related to different aspects of energy, environment and sustainability. This is the first time that such a voluminous and high-quality outcome has been achieved by any society in India from one conference.

The editors would like to express their sincere gratitude to the authors for submitting their work in a timely manner and revising it appropriately at short notice. We would like to express our special thanks to Prof. Nripen Chanda, Prof. Ashis Kumar Sen, Dr. Ankur Gupta, Dr. Rishi Kant, Mr. Pankaj Singh Chauhan, Prof. Shantanu Bhattacharya, etc., who have reviewed various chapters of this monograph and provided their valuable suggestions to improve the quality of the manuscripts. We acknowledge the support received from various funding agencies and organizations for successfully conducting the first ISEES conference SEEC-2017, where these monographs germinated. These include Department of Science and Technology, Government of India (special thanks to Dr. Sanjay Bajpai); TSI, India (special thanks to Dr. Deepak Sharma); Tesscorn, India (special thanks to Sh. Satyanarayana); AVL India; Horiba, India; Springer (special thanks to Swati Mehershi); CIAB (special thanks to Dr. Sangwan).

Almost all aspects related to environmental monitoring and control heavily rely on sensory systems which are critical to the maintainability of a good and safe environment with respect to time. This becomes more relevant and an important research theme as environment is being continuously challenged by emission and pollution from power systems, mobility sector, industrial sector, medical sector, etc. In short, wherever there is an issue related to waste management and disposability, the detrimental nature of such waste and their improper management needs to be sustainably monitored. If not monitored and addressed appropriately, such hazards may cause severe challenges for the health and well-being of living systems.

Technology emerged in different length scales has today led to the realization of precise and accurate sensory systems which are easily deployable and rapid in multitasking. In fact, the state-of-the-art research evolved the sensor domain into one where even the very minuscule and trace quantity of an analyte almost up to the level of a single molecule which may otherwise pose an environmental threat can be monitored through sensitive instrumentation and well-thought-out detection scheme.

This monograph is intended for researchers related to sensor design, fabrication and its various applications for the purpose of health and environment monitoring in a very large domain. We hope that the book would be of great interest to the professionals and postgraduate students involved in research related to advanced sensing techniques, fabrications and experimentation. The main objective of this monograph is to promote a better and more accurate understanding of sensing mechanisms and recent progress across all length scales in this domain.

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Environmental, Chemical and Medical Sensors

Bhattacharya, S.; Agarwal, A.K.; Chanda, N.; Pandey, A.;
Sen, A.K. (Eds.)

2018, XVII, 409 p. 187 illus., 146 illus. in color.,
Hardcover

ISBN: 978-981-10-7750-0