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PREFACE

Energy Materials for a Low Carbon Future

The development of low carbon energy technologies is widely accepted as among the most urgent challenges of our time in order to reduce carbon emissions that contribute to climate change and to deal with the emerging issue of air pollution. The performance of such technologies is crucially dependent on the fundamental properties of the component materials. Indeed, innovative materials science lies at the heart of advances that have already been made in the energy field; an excellent example being the rechargeable lithium-ion battery, which has been instrumental in advancing the revolution in portable electronics. It has become increasingly clear that the next generation of energy technologies depends critically on new materials, new approaches and greater understanding.

These important issues provided the stimulus for the Royal Society Discussion Meeting on '*Energy Materials for a Low Carbon Future*' in September 2018 on which this issue is based. This Discussion Meeting was a timely opportunity to bring together world-renowned experts with wide and complementary experience in the field of batteries, solar power, thermoelectrics and fuel cells, and highlighted cross-disciplinary approaches between scientists and engineers. The meeting aimed to survey the present state-of-the-art in materials chemistry, physics and engineering underlying modern low carbon energy technologies, and to identify those areas where fundamental developments in materials science are needed.

One of the highlights of the Discussion meeting was the 'flash' poster session of 25 one-slide, one-minute talks on the posters that were being presented by PhD students and postdoctoral researchers describing their latest discoveries. And all were on time! This made for a very exciting and lively poster session. Following the two-day meeting in London that was attended by more than 280 participants, a Satellite meeting was held at Chicheley Hall and attended by around 60 invited delegates; the workshop-type format of the latter meeting provided greater time for discussion on key issues relevant to modern energy materials research.

The meetings considered the challenges posed by solar cells, batteries, fuel cells and thermoelectrics, which was achieved by tackling a range of key cross-disciplinary themes including new materials discovery; transport processes; nanostructures and interfaces; and materials modelling and design; in addition to the scientific themes, societal and economic issues of climate change were also discussed. The cross fertilization of ideas and methods, including experiment, theory and computation, between application areas came out during the meetings, and will be critical for rapid progress.

Although general topics will be mentioned, it is beyond the scope of this editorial to give an exhaustive survey of all the excellent articles in this issue. A range of studies on energy materials are covered illustrating the breadth of high quality work. For instance, contemporary work on materials for 'beyond lithium-ion' battery technologies is illustrated by studies of magnesium- and sodium-ion batteries. Different features of thermoelectrics include articles on transition metal sulfides, nanostructured tellurides, oxide ceramics and organic materials. Recent advances in developing photovoltaics are illustrated by work on lead halide perovskite solar cells and p-type dye-sensitized solar cells.

As Editors, we would like to thank all the authors for their efforts in submitting a wide variety of high-quality peer-reviewed articles that advance state-of-the-art research. We are also grateful to the staff

at the Royal Society for their superb assistance in the organization of the Discussion and Satellite Meetings, and the preparation of this issue. Finally, we hope that this issue helps to capture the excitement of the meetings and also to illustrate the crucial role that fundamental research in materials science will play in the development of low carbon energy technologies.

Please insert photos here of the editors as in the Meeting webpage:

<https://royalsociety.org/science-events-and-lectures/2018/09/low-carbon-future/>

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(Attached is a higher res photo for Prof Saiful Islam)
