

Preface

The increase in the demand for energy by a growing world is stretching already maximized conventional resources to dangerously thin levels. Addressing this issue along with the need of a clean and sustainable approach to meet climatic challenges can be safely considered as the primary challenges for present and upcoming generations. Tapping the solar power—a well-established and historically proven approach—is still quite relevant as a solution to the aforementioned problems. This is because the global consumption (on the TW scale) can be met easily if one can tap into the sun's energy falling on the earth's surface over a small fraction of time alone. The challenge however lies in the limitations in harvesting this energy. While photovoltaics is a common, well-accepted, and commercially viable approach to solar energy utilization, the option of using solar power to produce hydrocarbon or hydrogen fuels is also equally fascinating. Admittedly, the technology is still in its infancy and will require an incubation period of a few decades to attain maturity. There are several approaches that can be pursued to make solar fuel generation a reality.

Utilization of solar energy and its conversion to value-added products such as electricity and fuels require seamless integration along several fronts. Material development, modeling-driven experiments, smart systems that integrate environmental remediation with simultaneous clean energy conversion, and strategies to mitigate greenhouse gas effects CO₂ fixation will all be critical to harnessing solar energy. The editors would like to point out that each of these areas is an independent topic that can be written about in considerable detail. This book strives to increase awareness about the breadth of solar energy application and the importance of solar fuels as an emerging area. The current level of knowledge and adaptation are at an elementary stage due to various factors including the critical mass of research activity in this important area. While many of the efforts in this direction may be frustrating, they must be pursued with vigor and innovation so that in the near future society can enjoy pollution-free energy conversion technologies. The chapters in this volume advance towards this goal.

The contributors to this book are experts in areas ranging from basic science and theory to application. This makes the set of papers compiled in the book an interesting and complementary read in the area of solar fuels. The editors are pleased to offer this compilation from an international group of authors with several decades of cumulative experience in areas allied to solar energy. The editors would like to thank the contributors for their thoughtful manuscripts and the publishers for proposing a book in such an emerging and important topic of energy research. We sincerely hope that this compilation gives perspective on the varied approaches to solar energy utilization with emphasis on solar fuels.

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