INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

In the present thesis, we explore a number of simple and cost-effective pathways to develop micro and nano devices useful for energy harvesting applications. The proof-of-concept prototypes developed can be employed to tap upon the clean and renewable resources of energy and convert them into other usable forms such as the electrical or chemical energy. In this regard, while microreactors are employed as advanced flow reactors for the conversion of solar energy into the chemical one, the mesoscale conducting polymer droplets are employed to convert solar to electrical energy. The content of the thesis is divided into four research objectives alongside an overall introduction (Chapter 1) in the beginning and important conclusions summarized at the end. The Chapter 2 of the thesis deals with microfluidic electrolysers for production and separation of hydrogen from sea water using naturally abundant solar energy. In the process, we also demonstrate the development of a potable, energetically self-reliant, environmentally-benign, and eco-friendly prototype for this purpose.

Following this, the Chapter 3, of the thesis deals with graphite and reduced graphene oxide coated paper based microelectrolyzer for the continuous production and separation of pure hydrogen and/or oxygen from sea water with the help of solar energy. In the Chapter 4, we demonstrate a microfluidic reactor for continuous production of organics from carbon dioxide and sea water in which the energy required for the reactions has been obtained from the electrical energy produced by a solar cell. In the process, we demonstrate an energetically self-reliant and eco-friendly device converting carbon dioxide into organic fuels. The Chapter 5 shows the details of the spin-dewetted conducting polymer droplets as micro/nano solar energy harvesters. Finally, we summarize the thesis in the Chapter 6 with the important conclusions drawn from the research objectives and the future scopes associated with the extension of these works.