

## RESEARCH DIVISION 1 – DENSE ENERGY CARRIERS

The Dense Energy Carrier Division will consolidate expertise in materials processing, advanced characterization and physics of semiconductor devices of LNNano/CNPEM with that of Universidade Estadual de Campinas (UNICAMP), Universidade Federal do ABC (UFABC) and Universidade Federal de São Carlos (UFSCar) in electrochemistry and photoelectrochemistry to develop state-of-the-art research in the field of solar driven routes to synthesize molecules via photoelectrochemical approach. Molecules offer the highest energy densities when compared to any form of electricity storage and are therefore referred to as 'Dense Energy Carriers (DEC)'. However, most of molecules used as fuel nowadays are processed by non-renewable and non-sustainable technologies or by bio-fuels technologies. Certainly, solar driven routes to synthesize molecules based on the photoelectrochemical approach are alternative ways to be explored in order to produce liquid fuel in a sustainable and "green" way. Keeping this in mind, the focus of this research division is the development of efficient solar driven routes to synthesize relevant product molecules from molecules that are widely available in the environment. In this way, we intend to explore the following routes to obtain high efficiency materials regarding the solar energy conversion into molecules: i) Understand materials and manufacturing challenges (e.g. thin films, inkjet printing, coatings, and atomic layer deposition process) ii) Development of novel materials and nanostructured materials (e.g. electrodes, and structured catalyst) for photoelectrochemical conversion iii) Production of H<sub>2</sub>, alcohols or hydrocarbons from CO<sub>2</sub> and water using electrochemical and photoelectrochemical conversion In terms of technology readiness level (TRL), i.e., in terms of technology maturity, most of our research projects are located in a level classified from 1 to 3. We intend to upgrade projects that reach TRL level 3 into TRL level 4 in the first 5 years of financial support. This will be the more important task of the Technology Transfer Coordinator (TTC), in the Innovation division of our research center. The main proposal is that the Innovation Division acts as a bridge between academic research and industrial research. Innovation Division will seek to fill the gap (in terms of TRL) between academic research and industrial development. The Innovation Division(...)

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### ABOUT THE PROJECT

FAPESP Process 2017/11986-5  
Term: Aug 2018 to Jul 2023  
Engineering Research Centers/Applied Research Center  
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will promote also workshops to demonstrate the technologies under development in the research division as well as, workshops to discuss the implementation of public policy for alternative and renewable energy. Other important point of our proposal are the activities that the Education and Dissemination of Knowledge division will implement during the duration of the project. Basically, two lines of action will be developed under this proposal: 1. prioritizing the theme of renewable energy, mainly related to solar driven routes to synthesize liquid fuels; 2. developing new products and specific projects. The planned actions will target different segments of the public, ranging from communication among the New Energy Research Center (NERC) researchers themselves to efforts directed to students (and teachers) from primary and secondary school, including also communication via the mainstream media (through press advisory activities) and activities aimed at the public at the beginning of their university education; these actions will also deal, concomitantly, with the elementary physical and chemical processes associated with the topics addressed and the more advanced applications to be developed during the investigations, as well as with cross-cutting issues such as, in particular, environmental issues.