



# Postdoctoral Research Opportunity

## Heterogeneous Catalysts for Water Splitting

### 1. General Details

**Institution:** University of Campinas<sup>1</sup> – Brazil

**Laboratory:** Laboratory of Prof. Juliano A. Bonacin (Bonacin Research Group)

**Field:** nanomaterials, inorganic materials, electrochemistry, water oxidation

**Application deadline:** February 01, 2018

**Beginning of activities:** July/August-2018

**Duration:** 1 or 2 years, according to the performance

**Fellowship value:** R\$ 4.100,00

### 2. Contextualization

Nowadays, the development of a viable alternative to fossil fuels is one of the big challenges of the governments and the scientific community. There is an estimate that world energetic consumption in the next 35 years may be almost double of the currently observed. Because of this, expansion of the energy matrix with fossil-based fuels such as coal, oil, and natural gas can lead to human race to the collapse. Based on this scenario, it is indispensable to study alternative sources of energy to meet this demand. Many strategies for using renewable energy sources have been inspired by the natural photosynthetic system, where water can be used as a source of energy through the production of hydrogen and oxygen. Water Splitting Reaction (WSR) can be defined as the splitting of water in oxygen and hydrogen to produce energy and it is nowadays one of the most important research themes in chemistry.

The production of molecular oxygen at the anode is the most energy-intensive step in the overall WSR. The water oxidation reaction is both thermodynamically ( $E^0 = 1.229 \text{ V vs NHE}$ ) and kinetically demanding, and so requires a catalyst to be accomplished. Thus, the study of different artificial catalysts for water oxidation can help understand the properties of this reaction and create new possibilities of energy production.

### 3. Problem to solve

The challenges for the development of catalysts for the oxygen evolution reaction (OER) are to obtain materials that operate in low overpotential, strong oxidizing conditions, and with high stability and robustness. Also, they must to be economically viable. In this sense, recent works presented in the literature have been shown the possibility of using coordination metallopolymer or electroactive coordination polymer (ECP) as water oxidation catalysts (WOC). Among them, it is possible to highlighted that one produced by pentacyanidoferrate (II) and cobalt<sup>2,7,8</sup>. The final material formed is an amorphous electroactive coordination polymer that operates in buffer solution around pH=7. Even that the observed performance be encouraging result, it is necessary further studies to decrease the overpotential of the electrochemical cell and increase the stability.

### 4. Project

The proposal is based on the development of inorganic nanomaterials to use as catalysts in studies of water splitting reaction specifically in oxygen evolution reaction.

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<sup>1</sup> <http://www.unicamp.br/unicamp/english>

## 5. Facilities

The Institute of Chemistry at UNICAMP is one of the most important research centers in Chemistry in the Brazil. It covers an area of approximately 32,000 m<sup>2</sup>, covering around 2100 m<sup>2</sup> of teaching laboratories, 7,100 m<sup>2</sup> of research laboratories, 2,000 m<sup>2</sup> of instrument rooms, 1,500 m<sup>2</sup> of workshops and warehouse and 1,320 m<sup>2</sup> for Library, in addition to classrooms, teacher' rooms, administrative area, and other facilities.

In our laboratory and the Open Facility of the Institute of Chemistry the candidates will find all necessary equipment for the execution of the projects. Also, we are located about 6 km of the Brazilian Synchrotron Light Laboratory (<http://lnls.cnpem.br/en/>).

## 6. Eligibility and Application

All candidates, young or experienced, are welcome to apply for a position, but foreigners must be eligible to request a regular situation in Brazil. Check the rules for visa<sup>2</sup>.

Motivated individuals to do high-quality research, independent and interested in solving relevant problems in chemistry are welcome. Candidates with a background in *inorganic chemistry*, *electroanalytical chemistry* or *physical chemistry* are encouraged to apply. Candidates must be able to write reports and scientific articles in English. The application must be addressed directly to Prof. Juliano Bonacin ([jbonacin@iqm.unicamp.br](mailto:jbonacin@iqm.unicamp.br)) and must include:

- i) one-page description about you and your relevant academic achievements, interests, and abilities to conduct the research;**
- ii) Short CV (two pages) including a list of your relevant publications;**
- iii) recommendation letter from your current supervisor;**
- iv) The names and contact of two personal references (scientist or senior professor).**

Selected applicants will be invited for an on-line interview.

## 7. How is the life in Campinas?

The first very important information is that there are no tuition fees at Unicamp. The contemplated candidate will receive a fellowship of R\$ 4,100.00 + research allowance to use in your project (R\$ 400.00 per month). Traveling expenses can be partly covered.

The living cost depends on your lifestyle but is possible to pay all your expenses with an amount of R\$ 2,200.00 - R\$2,700.00.

## 8. Contact



**Prof. Juliano A. Bonacin (** [jbonacin@iqm.unicamp.br](mailto:jbonacin@iqm.unicamp.br) **)**

**Website:** [www.bonacin.iqm.unicamp.br](http://www.bonacin.iqm.unicamp.br)

**University of Campinas, Institute of Chemistry, Dep. of Inorganic Chemistry**

**Josue de Castro Street, PO Box. 6154, ZIP Code: 13083-970**

**Cidade Universitária, Campinas-SP, Brazil Laboratory: I-113, Office: I-111**

<sup>2</sup> <http://www.portalconsular.itamaraty.gov.br/vistos-para-viajar-ao-brasil>