

滞在記 Dr. Rabah Boukherroub

高次機能ナノプロセス技術に関する研究 (V B L)

受入教員 : GELLOZ, Bernard Jacques (准教授・理学研究科・理学専攻)

招待客 : Dr. Rabah Boukherroub (Senior Scientist at CNRS, France); VBL 外国人客員教員 (22/06/2026 – 23/07/2026).

Work address in France: Institute of Electronics, Microelectronics and Nanotechnology (IEMN), CNRS & University of Lille, Cité Scientifique, Avenue Poincaré – CS60069, 59658 Villeneuve d'Ascq, France)

Objectives of the research and stay of Rabah Boukherroub:

The objectives were for Dr. Boukherroub to (i) act as consultant, bringing his expertise in chemistry to different Physics and Materials research laboratories at Nagoya University (Prof. Gelloz, Prof. Wang, Prof. Kishida), and (ii) start a research collaboration and initiate experimental work with Prof. Wang (Engineering/Materials) and Prof. Gelloz (Science/Physics), on the topic of silicon-based photo-materials for both effective reduction of CO₂ into added-value chemicals and hydrogen production by water splitting. He also had to deliver a seminar at VBL.

Achievements and perspectives:

Dr. Boukherroub had several meetings with Prof. Qian Wang and Prof. Bernard Gelloz. An initial research plan was decided and preliminary experiments were conducted. This collaboration will continue after Dr. Boukherroub has left Nagoya University.

First, some silicon-based photoanodes for water splitting were prepared. Two different ways of depositing cocatalysts on these photoanodes were implemented: using electrodeposition in Prof. Wang laboratory or e-beam evaporation in VBL (with the help of Prof. Haejeong Cheong). These as formed photoanodes show promising photo-electrical characteristics for water splitting. Prof. Gelloz introduced another experimental method for fabricating the silicon electrodes (using Teflon tape) to Prof. Wang Laboratory. The method allows easier material processing and characterization, especially after electrochemical deposition of catalysts.

For the future, to optimize the photoanode characteristics, we propose to perform a series of investigations, including studying the effect of catalyst coverage and photoanode annealing. Furthermore, the effects of high-pressure water vapor annealing will be studied. This treatment, introduced by Prof. Gelloz, is expected to stabilize and enhance the performance of the photoanodes.

Photoelectrochemical experiments will be performed not only for water splitting, but also for small organic molecules oxidation with a view to producing added-value chemicals.

Dr. Boukherroub also had meetings with Prof. Hideo Kishida and Prof. Bernard Gelloz. During these meetings, he discussed in depth his knowledge of deep eutectic solvents (DESs), which he had introduced to Prof. Kishida during his previous stay at Nagoya University last December (IAR program; invited by Prof. Gelloz). DESs present many advantages compared to ionic liquids. Prof. Kishida is now considering using DESs in the fabrication of a particular device in his research. DESs were also discussed in detail with Prof. Gelloz for an application in silicon nanostructure optoelectronics.

Dr. Boukherroub gave a seminar entitled “advanced electrocatalytic materials for the sustainable production of fuels and chemicals” on July 22nd, 2026, at VBL.