

(For JSPS Fellow)

Form B-5

Date (日付)

27/11/2013 (Date/Month/Year: 日/月/年)

Activity Report -Science Dialogue Program-

(サイエンス・ダイアログ事業 実施報告書)

- Fellow's name (講師氏名): Kenji Sumida 隅田健治 (ID No. P12040)

- Participating school (学校名): 愛知県立春日井高等学校

- Date (実施日時): 25/11/2013 (Date/Month/Year: 日/月/年)

- Lecture title (講演題目): (in English) Design and Synthesis of New Materials for a Sustainable Energy Future

(in Japanese)

- Lecture summary (講演概要): Please summary your lecture 200-500 words.

The following text represents the abstract that was sent to the school several days prior to the lecture.

The growing world population, increasing scarcity of natural resources, and escalating concerns over climate change have placed a great urgency on the development of new technologies that allow energy to be generated, transported, and used in a cleaner and more efficient way. This is an enormous challenge that engages not only my field of materials science, but also physicists, biologists, engineers, and even economists and politicians. My work is focused on the discovery of new materials that can act as a platform for the *storage and separation of gas molecules*. These are two very important industrial processes that are crucial to developing our future energy framework, and I will introduce you to two specific applications where I have devoted my recent research efforts.

(1) Hydrogen Storage: Hydrogen is a very attractive fuel to replace gasoline in vehicles because it is clean-burning (it only generates water when burned), and has a very high energy density. However, because it is a gas, it occupies a very large volume, and needs to be safely and compactly stored.

Key Question: How can we store hydrogen in a more compact form, and in a safe and efficient way?

(2) Carbon Capture: In many countries, the use of coal and natural gas for generating electricity is rapidly growing. However, these are not environmentally-friendly resources because of the large amount of CO₂ that is emitted into the atmosphere when they are burned. However, there are not many cleaner alternatives currently available to us, and each has problems associated

with its use (e.g. solar, nuclear, wind, etc.).

Key Question: How can we use abundant coal and natural gas, but reduce CO₂ emissions?

To address these problems, my work focuses on creating new solid materials called *metal-organic frameworks*, which look rather like jungle gyms if you could zoom in to see the individual atoms (see below). These are very low-density (porous) materials that have a very high surface area (a single gram of these materials can have a surface equivalent to that of a soccer field!), and are also chemically tunable. This means that we have an opportunity to create very high-performance materials to address the challenges mentioned above. In my presentation, I will introduce you to my research field and hope you will share my interest in contributing towards a more sustainable future.

- Language used (使用言語): English

- Lecture format (講演形式):

◆Lecture time (講演時間) 45 min (分), Q&A time (質疑応答時間) 10 min (分)

◆Lecture style (ex.: used projector, conducted experiments)

(講演方法 (例: プロジェクター使用による講演、実験・実習の有無など))

In-class presentation using Powerpoint

◆Interpretation (ex.: assistance by accompanied person, provided Japanese explanation by yourself) (通訳 (例: 同行者によるサポート、講師本人による日本語説明))

I used some Japanese keywords when required (self-interpreted)

◆Name and title of accompanied person (同行者 職・氏名)

None

◆Other note worthy information (その他特筆すべき事項):

approximately 30 students, and 10 junior high school teachers from Gifu prefecture attended the lecture

- Impressions and opinions from accompanied person (同行者の方から、本事業に対する意見・感想等がありましたら、お願いいたします。):

I was not accompanied by another person on my visit.