

(For JSPS Fellow)

Form B-5

Date (日付)

24/02/2017 (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): Dr Sreekuttan M Unni (ID No. P15377)

- Participating school (学校名): Kofu Minami High School

- Date (実施日時): 17/02/2017 (Date/Month/Year: 日/月/年)

- Lecture title (講演題目): (in English) Fuel Cell: A Pollution-free Energy Conversion Device

(in Japanese) 燃料電池: 無公害エネルギー変換デバイス

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

My lecture at Kofu Minami High School mainly focused on the green energy devices particularly fuel cells. I started my lecture by giving a brief introduction to India, and its religion, culture, food, etc. to say the unity is existing in diversity. I, slowly move to the educational systems of India and my research career. Later discussed the reason I chose Japan for my future studies.

After, this brief discussion, I started my main research topic about green energy device. Global warming is a major concern all over the world. Its impact on Earth is day by day getting worse. The main reason for the global warming is anthropogenic, ie., human-based activities. It includes deforestation, industrialisation, mining, petroleum fuels, etc. Since it has an adverse effect on earth, the world is trying to reduce the conception of fossil fuels because it contributes a significant part of the production of carbon dioxide which is a main reason for the global warming. The usage of green, renewable energy devices is a better option as a suitable alternative to fossil fuels. Among different green energy resources, hydrogen is the best option to compete with fossil fuels. Hydrogen can be produced from water using photochemical reaction. It is an energy efficient and pollution-free method. However, the major issue existing when hydrogen is using as fuel is its storage.

The device which converts the chemical energy in hydrogen is fuel cells. It can be applied in varieties of applications includes the portable and stationary use. William Grove first introduced the concept of the production of electricity from hydrogen in 1839, and he is considering as the father of fuel cells. Later tremendous modifications in the fuel cell research occurred and S. Korea even constructed a power plant based on fuel cells in 2015. Depending on the operation temperature and the electrolyte used in the fuel cells, it is being called by several names. Polymer electrolyte membrane fuel cells (PEMFCs) is one among them where polymer membrane is using as an electrolyte, and it is operating below 100 oC. It can also be applied in

portable application mainly vehicle application. Since its operation is at low temperature, the precious catalyst such as Pt required for the efficient electrode reactions. It ultimately increases the cost of the device. The best option is to replace the Pt-based catalyst with cost-effective, Pt-free catalyst to catalyze the electrode reactions mainly oxygen reduction reaction (ORR) at the cathode. The carbon-based catalyst is the best option to replace Pt from the electrode of fuel cells. However, pure carbon is inactive for catalyzing the reaction, and heteroatom doping is necessary to activate the carbon catalyst to perform ORR comparable with Pt. In the end, I discussed two slides about my research activities towards the development of Pt-free catalyst for PEMFC. The presentation concluded by discussing the future direction of fuel cells and an interactive section.

- Language used (使用言語): English

- Lecture format (講演形式):

◆Lecture time (講演時間) 70 min (分), Q&A time (質疑応答時間) 20 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))

Power Point Presentation (Used Projector)

◆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))

Assistance by accompanied person

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

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

- 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。):

今回、サイエンス・ダイアログ事業に同行させてもらい、自分自身もとても良い経験になりました。まず高校1年生に対して質問された場合どのように回答すれば理解してもらえるか、Unni さんのおっしゃったことを補足して日本語で的確にフォローできるかなど普段の生活では味わえないことでとても新鮮でした。また Unni さんと英語でコミュニケーションをとりながら山梨まで向かうことも英語で話すことが苦手であった私にとってとてもいい経験となりました。このように同行させていただいた自分にとってもいろいろ得られた事業であると感じました。