Strategic Young Researcher Overseas Visits Program

for Accelerating Brain Circulation 2011

"Development of Young Researchers Based on International Joint Research on Green Energy Systems" Progress Report

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2. Title: Assistant Professor

3. Host Institution: Technische Universiteit Eindhoven (Eindhoven University of Technology, the Netherlands)

4. Host Researcher: Professor Bart Noordover

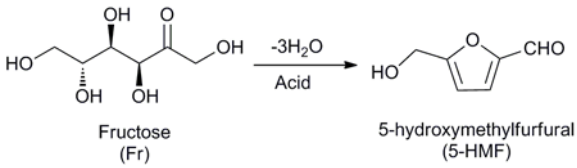
5. Duration: 25-May-2013 – 25-March-2014

6. Research Topic: Development of Novel Bio-based Polymer Synthesis

7. Overview of the Results of the Collaborative Research:

Lithium ion batteries are widely used for portable electronics and electric cars.
Popular electrolyte used in the commercial Lithium ion batteries is organic electrolyte, they have some troubles due to their leak or/and explosion. To solve this problem, various solid polymer electrolytes have been studied. Recently, Prof. Noordover and co-workers reported that synthesis of novel bio-based polymer from saccharide or its derivatives.
On the other hands, efficient conversion of biomass to available materials has recently received considerable attention as a potential technology in challenging issues for changing raw materials from petroleum to natural sources. Saccharide is a kind of biomass, and

composed of 5 or 6 carbon atoms. Especially **Fr** is an abundant monosaccharide obtained from honey, fruit, and beet. A typical transformation of **Fr** is 5-hydroxymethyl-2-furfural (5-HMF) which is versatile compounds for conversion to a variety of chemicals (Scheme 1). The reaction proceeded via successive dehydration in the presence of acid catalysts. Instead of Brønsted acid used in earlier studies, a variety of heterogeneous catalysts have been used in the dehydration of **Fr** to 5-HMF for convenience of separation and recycling. The aim of this research is to develop an efficient synthesis of some chemicals and novel polymers from bio-based compounds.



Scheme 1. Dehydration reaction of fructose to 5-HMF.

We could find that saccharide can be converted to 5-HMF in the presence of Brønsted acid catalyst under high pressure carbon dioxide. The yields and selectivity were affected by the reaction conditions (i.e. reaction time, temperature and pressure of CO2). We will apply to synthesis of the bio-based polymer from obtained chemicals.

8. Deployment Plans for Future Collaborative Research:

We could find that **Fr** can be easily converted to 5-HMF under high pressure carbon dioxide. Thus, we have an agreement to continue our collaboration on the research of the bio-based polymer synthesis.