JCEJ Outstanding Paper Award of 2014

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Outstanding Paper Awards Subcommittee of *Journal of Chemical Engineering of Japan* has assessed the 131 papers published in volume 47 into 2014, and the editorial board finally selected the five papers for JCEJ Outstanding Paper Awards of 2014; those are the papers on “Mechanism of the Initial Phenomena of Defluidization Caused by Switching Fluidizing Gases,” “Purification of Pt-Loaded Carbon Nanoparticles by Dielectrophoresis,” “Reaction Analysis of Ethanol Electro-Oxidation on PdRu/C Catalyst at Intermediate Temperature,” “Novel Nickel Catalysts Based on Spinel-Type Mixed Oxides for Methane and Propane Steam Reforming,” and “Prediction of Molten Steel Temperature in Steel Making Process with Uncertainty by Integrating Gray-Box Model and Bootstrap Filter.”

JCEJ Paper Award is given for outstanding contribution to chemical engineering documented in a paper published in *Journal of Chemical Engineering of Japan*. The selection is made by means of a three-stage process consisting of nomination, first round elimination, and point rating. Outstanding Paper Awards Subcommittee of the journal has assessed the 131 papers published in 2014, corresponding to volume 47. The subcommittee selected the candidates of the award and the members of the editorial board confirmed the selection. As a result of this process, the editorial board finally selected the following five papers for the award of 2014.

1. “Mechanism of the Initial Phenomena of Defluidization Caused by Switching Fluidizing Gases” by Takami Kai, Yuki Hirano, Tsutomu Nakazato, and Kei Mizuta, Kagoshima University (Kai *et al.*, 2014)

Citation: In this paper, the authors have proposed a model using the unsteady-state diffusion equation and Kozeny–Carman equation to study transient defluidization that occurs after the fluidizing gas is switched to another gas, and showed that experimental pressure changes for a binary diffusion system in a packed bed could be well predicted by the model without the inclusion of any adjustable parameters. This result confirms that the defluidization is caused by non-equimolar gas exchange between the bubble and the emulsion phases. The result gives clear understanding in the field of particles fluidization when fluidizing gas is switched from lower to higher density. Therefore, this paper deserves the Outstanding Paper Award.

2. “Purification of Pt-Loaded Carbon Nanoparticles by Dielectrophoresis” by Noriaki Sano, Yosuke Iwasaki, and

Hajime Tamon, Kyoto University (Sano *et al.*, 2014)

Citation: This paper investigates the dielectrophoresis (DEP) separation of Pt-loaded carbon nanoparticles (Pt-CNP) by using patterned Cu electrodes in ethanol. They found four important parameters such as the speed of the electrode lifting motion, the amplitude of AC voltage applied to the DEP electrodes, the frequency of this AC voltage, and the duration of dipping electrodes before lifting. They showed the optimization of these parameters and the addition of a surfactant gave high purification factor. The findings presented in this paper bring about improvement of the Pt-CNP purification and therefore selected as an outstanding paper.

3. “Reaction Analysis of Ethanol Electro-Oxidation on PdRu/C Catalyst at Intermediate Temperature” by Iori Shimada, Yoshito Oshima, and Junichiro Otomo, Shinshu University and The University of Tokyo (Shimada *et al.*, 2014)

Citation: In this paper, a mechanistic study on ethanol electrooxidation over PdRu/C catalyst is reported, seeking for a non-Pt catalysis. Authors have investigated ethanol electrooxidation at approximately 250°C adopting a PdRu/C catalyst synthesized by a liquid phase reduction method. The PdRu/C catalyst showed high activity for hydrogen production reaction, one of the elementary processes on the catalyst, comparable to that on the PtRu/C catalyst, which results in high current density at low electrode potentials. Oxidation of the adsorbed C1 species is identified as the probable rate-determining step at the intermediate temperature. Directions for further activation of the PdRu/C catalyst is shown on the basis of the reaction mechanism clarified in the authors’ study.

4. “Novel Nickel Catalysts Based on Spinel-Type

Mixed Oxides for Methane and Propane Steam Reforming” by Ryuji Kikuchi, Misato Yokoyama, Shohei Tada, Atsushi Takagaki, Takashi Sugawara, and S. Ted Oyama, The University of Tokyo (Kikuchi *et al.*, 2014)

Citation: In this paper, authors report the development of novel nickel catalysts based on magnesium aluminate spinel-type mixed oxides for hydrogen production via hydrocarbon reforming. The catalyst with different preparation methods and compositions were investigated to successfully develop an excellent catalyst in terms of hydrocarbon conversion and carbon deposition tolerance. Under the condition investigated, the authors have confirmed one-eighth of carbon deposition on a developed catalyst compared with a conventional Ni/ γ -Al₂O₃ catalyst. The results will allow the operation of hydrogen production system under smaller safety ratio, leading to the cost reduction of the system.

5. **“Prediction of Molten Steel Temperature in Steel Making Process with Uncertainty by Integrating Gray-Box Model and Bootstrap Filter”** by Iftikhar Ahmad, Manabu Kano, Shinji Hasebe, Hiroshi Kitada, and Noboru Murata, Kyoto University, Nippon Steel and Sumitomo Metal Corporation, Ltd., and Waseda University (Ahmad *et al.*, 2014)

Citation: This paper proposes a method to predict the probability density of molten steel temperature in a container, called a tundish, used to feed molten steel into an ingot mold. The proposed method integrates a gray-box model and a bootstrap filter to cope with uncertainties of the process. The predicted probability distribution realizes precise

control of the molten steel temperature, and contributes to a stable operation of a continuous casting process. The procedure was validated through its application to real operation data at steel works and the result satisfied the requirement for its industrial application. Thus this paper deserves to the Outstanding Paper Awards.

Congratulations to all the award winners. Winners present their awarded work at the 47th Autumn Meeting of the Society of Chemical Engineers, Japan.

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