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A Thermoelectrochemical Cell and a Host–Guest Chemistry

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The control of ion dynamics is important for storage and harvesting of electric energy. We intended to apply molecular-based knowledge to the ion dynamics for harvesting or converting various kinds of energy to electric or electrochemical energy.

Recently we focused on thermoelectrochemical cell which can convert heat flow into electric energy. This cell is quite similar to conventional thermoelectric materials, and the merit of the thermoelectrochemical cell is the high voltage by the unit temperature difference (Seebeck coefficient), which affects critically to the thermoelectric energy conversion as well as heat sensor.[1,2] We introduced supramolecular way of control in the thermoelectrochemical cell. By introduction of host material, one of the redox pair was selectively captured at cold electrode and the captured redox active species became inert by the incorporation. The redox species was released at the hot side, and the ratio of concentration of the redox pair was unbalanced between the two electrodes. As a result, difference of voltage can be made according to the Nernst equation.

This method requires the following three features to the host materials;

- Selective binding of the host compounds to one of the reductant or oxidant and electrochemically perturbed by the binding
- Construct binding of guest species at cold side and release it at hot electrode
- Reversible capture and release

We demonstrated that supramolecular host–guest interaction is suitable for the requirement.

We also succeeded in obtaining voltage by use of selective ionic conduction in solid-state electrolyte. Details will be reported on the seminar.

(1) Abdullah, N.; Noor, N. L. M.; Nordin, A. R.; Halcrow, M. A.; MacFarlane, D. R.; Lazar, M. A.; Pringle, J. M.; Bruce, D. W.; Donnio, B.; Heinrich, B. *J. Mater. Chem. C* **2015**, *3*, 2491.

(2) Abraham, T. J.; MacFarlane, D. R.; Pringle, J. M. *Chem. Commun. (Camb).* **2011**, *47*, 6260.