MERIT Internship Report

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【Date】

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【Host institute】

Energy Interface Technology Group, Research Institute for Energy Conservation (iECO), Department of Energy and Environment, The National Institute of Advanced Industrial Science and Technology (AIST)

【Outline】

The host research group focuses on elucidation of physical and chemical phenomena at the interface between solid, liquid and gas, and development of clean energy storage and conversion devices. Our group has main interest for control and functionalization of self-assembled nanostructured materials from the stand-point of organic and polymeric chemistry and liquid crystalline material science. My research interest lies on development of ion conductive nanostructured materials and application of these to energy devices. From these research background and for collaboration, liquid-crystalline ion conductive materials were combined with inorganic electrode materials to develop energy devices. These electrochemical properties were evaluated.

【Activities】

Coin-type lithium-ion cells were assembled. Lithium iron phosphate as cathode materials, binder and conductive additive were dispersed in an organic solvent to prepare slurry. The slurry was applied on aluminum foil. The applied slurry was dried and the foil was cut by a metal mold. The uniform application of electrode materials was confirmed by weighing the cut foil. Coin-type lithium-ion cells using typical organic electrolytic solution were examined by charge-discharge experiments and cyclic voltammetry. Lithium-ion cells using surface-treated electrodes and lithium-ion conductive liquid crystals as electrolyte were also prepared. The electrochemical stability of liquid-crystalline electrolytes during charge-discharge processes were explored by charge-discharge experiments and cyclic voltammetry.

I visited SPring-8 and participated in discussion during 26-28 July. Main research topic there was study on electronic structures of electrode materials during charge-discharge experiments by operando observation of soft X-ray photoelectron spectroscopy. In addition,

I had a good experience to know various research topics conducted in SPring-8.

I could learn not only about research topics but also about technical trends in industry from daily conversation to researchers in AIST. It was impressive for me to hear about the difference of safety standard for batteries for EVs in Japan and overseas, industrial trends and issues regarding to inorganic solid electrolytes for lithium-ion batteries, which have attracted great interest for wider spread of EVs, phenomena concerning deterioration of current lithium-ion batteries, and importance of cost cut for manufacturing process and of sealing materials, which is a key component determining the life time of organic solar cells.

I participated in “AIST innovation seminar” held in lunch time, which is aimed for promotion of interdisciplinary research activities. A relatively young researcher gave us a presentation entitled “Past, Present and Future of Artificial Hearts,” which explained the history, current status and future prospects of artificial hearts. It was not only very easy to understand even for a layman like me, but also interesting from the aspect of materials science. I learned about research overview of artificial hearts and frontier of medical technology from the view of engineering.

【Acknowledgement】

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