

# 3<sup>rd</sup> International Conference and Exhibition on Materials Science & Engineering

October 06-08, 2014 Hilton San Antonio Airport, USA

## Proton-conducting tin phosphates for electrochemical applications operating at intermediate temperatures

Masahiro Nagao

Nagoya University, Japan

This report describes proton conduction in doped  $\text{SnP}_2\text{O}_7$  at temperatures of 100-300°C. When  $\text{Sn}^{4+}$  is partially replaced by  $\text{In}^{3+}$ , the proton conductivity of 10 mol%  $\text{In}^{3+}$ -doped  $\text{SnP}_2\text{O}_7$  is greater than  $10^{-1} \text{ S cm}^{-1}$  at temperatures of 125-300°C. Conductivity reaches  $1.95 \times 10^{-1} \text{ S cm}^{-1}$  at 250°C. Highly conductive protons in  $\text{In}^{3+}$ -doped  $\text{SnP}_2\text{O}_7$  are achieved through a reaction between water vapor and an electron hole, which is introduced by the low-valence atom substitution for  $\text{Sn}^{4+}$ . Because such high conductivity in an intermediate temperature region has never been reported, we have launched the concept for application to electrochemical devices such as fuel cells, gas sensors, reactors and batteries. For example, a salient benefit of the intermediate-temperature operation is that fuel cells using a Pt catalyst can be freed from CO poisoning. The fuel cell showed high tolerance toward 10% CO in fuel and showed the high power density of  $264 \text{ mW cm}^{-2}$  at 250 °C. When we used the dimethyl ether as a fuel, the fuel cell with PtRu/C anode achieved the peak power density of  $78 \text{ mW cm}^{-2}$  at 300°C. Moreover, because high catalytic activity is expected when the operating temperature is increased, non-Pt catalysts were explored as alternative anodes. Among the tested candidates,  $\text{Mo}_2\text{C-ZrO}_2/\text{C}$  anode showed a cell performance comparable to that of the Pt/C anode.

### Biography

Masahiro Nagao completed his PhD at Nagoya University. He has authored or co-authored more than 25 publications in peer-reviewed journals. His research interests include high ionic conductive materials and their application to electrochemical devices.

[nagao@urban.env.nagoya-u.ac.jp](mailto:nagao@urban.env.nagoya-u.ac.jp)