CEE

YOKOKAWA LAB.

[Activating Utilization of SOFC]

Collaborative Research Center for Energy Engineering

Electrochemical Energy Conversion Technology

http://www.Yokokawa.iis.u-Tokyo.ac.jp/

Activating Utilization of SOFC

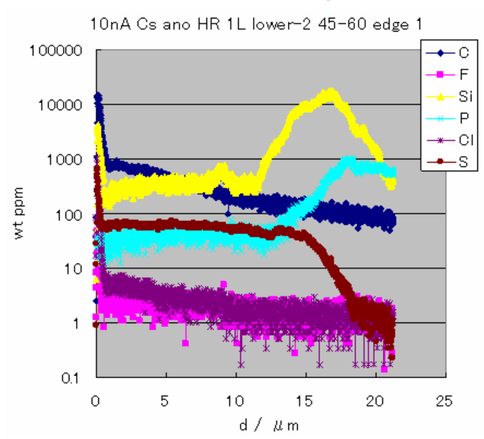
Fuel Cells are a next-generation energy converter and will be applied in various fields in which conventional thermal engines (engine, turbine etc.) have been utilized. In particular, Solid Oxide Fuel Cells can provide high conversion efficiency by adopting an interesting way of converting exhausted heats to chemical energies despite high temperature fuel cells are, in principle, thermodynamically unfavorable.

Energy converters such as fuel cells are commonly compared with measures of efficiency, cost and life. Developers mainly focus on cost reduction, whereas it is highly required to achieve high durability simultaneously. At present, NEDO project on durability has been conducted as cooperative investigations among industries and academia to establish long lifes rapidly. As fundamental research institutes, in addition to Utokyo, AIST, CRIEPI, KyushuU, KyotoU, TohokuU are participating.

Osaka gas and Kyocera developed low cost cells and confirmed their durability and make new ENEFORM S-type systems as Clue in the New Electric Marcket era.

- Ifabrication procedure as well as materials have strong impacts on degradations.
- Operational conditions such as temperature, current density also affect degradations. Interestingly, grater degradations are found with lowering operation temperature. On the other hands, essentially no diffusion occurs around 700-900ºC, indicating intrinsic high durability of SOFCs.
- Degradations are caused by diffusion in particular substances such as ceria.
- Chemical and electrochemical reactions are both involved in degradations.
- Recent recognition that interactions among various phenomena occurring in a stack becomes important at low degradations suggests future important trend in cooperative investigations.

No. 1 SIMS by AIST



No. 2 FIB-SEM by KyotoU/Utokyo Ni-YSZ by TOTO

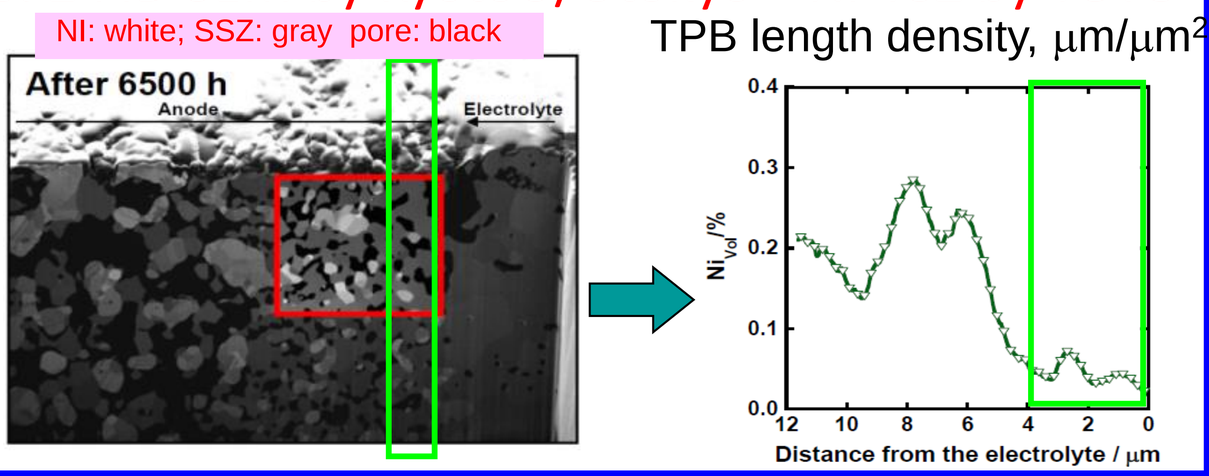


Fig. 1 Degradation of Ni/YSZ anode by TOTO: 1) SIMS by AIST indicates deposition of P, SI at anode-electrolyte interface; 2) FIB-SEM analyses by KyotoU/Utokyo revealed the depletion of Ni out of the interfaces.