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Effect of H_2S contamination on SOFC performance at different pressure conditions.

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In Japan, the integrated gasification combined cycle (IGCC) has been developed as one of the promising technology for efficient power generation from coal [1,2] In order to realize the efficient coal-based power generation with reduced carbon emission, new large-scale demonstration project on the oxygen-blown IGCC was launched in 2015 in Japan.[3] This project, Osaki CoolGen Project, aims to develop the advanced IGCC plant with carbon capture process to realize the higher efficiency and reduced carbon emission in the coal-based power generation. As an extension of such current R&D and demonstration about the IGCC, the incorporation of fuel-flexible SOFC (Solid Oxide Fuel Cell) into the coal gasification-based power plant could be considered, which is often called as the integrated gasification fuel cell combined cycle (IGFC).

However, coal-derived syngas produced in pressurized coal gasifier contains trace chemical impurities such as S, Cl, volatilized metallic species etc. In this case, it is necessary to know the impacts of trace impurities in the produced fuel syngas on the performance of Ni-YSZ anode at pressurized condition.

We have conducted power generation tests using electrolyte-support button-type single cell fueled by hydrogen with trace level of H_2S at ambient or elevated pressures to see whether the pressure condition will affect the performance. We found that the polarization resistance over the anode was decreased as increase in the pressure, giving better performance of the cell by the pressurization. However, we also found that the increase in the polarization resistance caused by the H_2S at pressurized conditions were larger than that at ambient conditions, suggesting that the increase of partial pressure of H_2S under the pressurized condition results in interference the electrochemical oxidation of fuel at three phase boundaries.

References

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[2] S. Ashitani, Proceedings of Clean Coal day in Japan 2011 International Symposium, Tokyo, Japan, (2011)

[3] http://www.osaki-coolgen.jp/english/index.html