**Development of a highly efficient fuel cell system**

**Sanggyu Kang1,2\***

1Korea Institute of Machinery and Materials (KIMM), Gajeongbuk-ro 156, Yuseong-gu, Daejeon, Republic of Korea

2University of Science and Technology (UST), Gajeong-ro 217, Yuseong-gu, Daejeon, Republic of Korea

\*Presenting and Corresponding Author: kyu2613@gmail.com

Fuel cell system has been regarded as a promising alternative power source for the mobile and stationary application due to high efficiency and low emission. However, the efficiency and the stability of the fuel cell system has to be more enhanced to be commercialized. Even though the system is integrating the high performance stack and high performance BOP (balance of plant) components, the system efficiency enhancement cannot be achieved without system optimization process. The optimal design of the highly efficient fuel cell system can be developed by system thermodynamic analysis with consideration of the heat and mass balance. Recycle of the anode-off gas and hybridization with other conventional power generation are one way to increase the system electrical efficiency.

In order to increase the stability of the fuel cell system, the system dynamic behavior has to be captured during transient conditions such as start-up, load changes, stop, and shut-down. Multi-dimensional system dynamic modeling which is resolving the reaction kinetics, heat transfer, and mass transfer can predict the system operation during transient conditions. The model has to be developed to capture the detail phenomena occurred in the components and the system with high accuracy and low computational load. The system dynamic modeling can be used to develop the optimal control strategy for the fuel cell system.

The technology development for the system optimization and the system dynamic modeling can contribute to commercialization of the fuel cell system.