Engineering Perspectives on the Commercialization of PEM Fuel Cell and Water Electrolysis

Hui Li
Southern University of Science and Technology, Shenzhen, Guangdong, China

Abstract:

Since early 2016 fuel cell (FC) technology has been experiencing unprecedented opportunity for large scale commercialization in China. All levels of governments are investing heavily in FC development and applications and provide heavy incentives for FC vehicles. As a result, many automotive OEMs started to launch plans for deploying FC buses which will be in need of a few hundreds, in some cases a few thousands, FC stacks. In response to this explosive market drive, over a hundred FC start-up companies came to existence within one year and their businesses are mainly on integrating fuel cell stacks or fuel cell systems into vehicles. Last year has seen substantial progress at the fuel cell system level in resolving vehicle-integration challenges to meet automotive performance and durability requirements. These progresses as well as the staggering number of planned deployment of FC vehicles in China stimulates an anticipation in fuel cell community that China's market may finally bring up the volume of FC vehicles that will be sufficient, according to DOE projection, to bring the FC system cost from projected $55 /kW to reality. However, the FC system cost would still be too high compared to the ultimate goal of $35/kW to compete with ICE.

To overcome the last gap in cost of FC systems, most of the current efforts have been on materials particularly on catalysts. Significant progress has been achieved in developing a variety of novel and highly active cathode catalysts as well as non-precious metal catalysts as substitutes of conventional Pt/C catalysts as a way of reducing catalyst cost. However, the high activities of these catalysts have not been manifested at membrane electrode assembly (MEAs) level due to the limitation of "material-only" approaches and the lack of engineering consideration. Much less progress has been made in developing large-scale commercial low PGM loading MEAs. In spite of the research progress in reducing Pt loading from 0.5 mg Pt/cm^2 to about 0.1 mg Pt/cm^2, the poor performance of the MEAs at high current density presents challenges that can only be dealt with from an engineering angle. This presentation will provide some engineering perspectives in overcoming the remaining challenges of FC commercialization.