Development of planar sodium sulfur cells

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Abstract:

A planar sodium sulfur cell (NaS) with a stand-alone cell design has been developed for high power energy storage systems (ESS) applications. Upon designing the cells, an intensive thermal stress analysis has been conducted in order to (1) maximize the volumetric energy density and to (2) mitigate the maximum local stresses during freeze/thaw cycles. The analysis is of great importance in designing the high temperature sodium batteries since the thermal stresses at the joints become larger as the cell size increases. To avoid the cell failure, the maximum local thermal stress should be sufficiently smaller than the bonding strength at the heterogeneous joints bonded via gas tight sealing which enable the cells to be standing alone. At the same time, all the cell components and cell fabrication process including state-of-the-art joining technologies for high temperature sodium batteries have been developed, such as electron beam welding (EBW), thermal compression bonding (TCB), and glass sealing for metal-metal, metal-ceramic, and ceramic-ceramic joints, respectively. The comprehensive efforts enabled us to successfully fabricate different sizes of planar sodium sulfur cells (up to 120 mm in diameter of a β/β"-Al_2O_3 solid electrolyte), and their electrochemical cell characteristics will be presented upon discharge-charge cycles at the current densities of 100~400 mA/cm^2.

Biography:

Dr. Keeyoung Jung is currently leading a research team at RIST developing planar sodium beta-alumina batteries (NBB) with sodium sulfur (NaS) and sodium metal halide (NaMH) chemistries targeting at commercialization of the advanced batteries. He is also working as a key member on development of 5~100kWh scale ESS systems based on tubular sodium sulfur cells for grid scale energy storage applications.

He was previously working on materials at elevated temperatures for gas turbines/jet engines, ultra-light solid oxide fuel cells, and oxyfuel combustion as a research faculty at the University of Pittsburgh, and at the same time as a researcher at the National Energy Technology Laboratory (NETL). He was educated from Korea University, Carnegie Mellon University, and University of Pittsburgh for his BS, MS, and PhD, respectively. He authored and co-authored more than 30 publications, and holds 60 patents. Dr. Jung is honored to be a recipient of *2014 Energy Technology Innovation Award* by the Ministry of Trade, Industry and Energy (MOTIE) of the Republic of Korea, and *Henry Merion Howe* medal by ASM International in 2005. He is currently a member of ECS, KECS, TMS, ASM, KOBS, and KIM, and organizing an energy storage symposium at MS&T since 2011.