A Current-Independent Constant Anode Voltage Loss Using Sm-doped Ceria Electrolytes in SOFCs

Author: Tomofumi Miyashita
Affiliation: Miyashita Clinic
Address: 1-6-3, Mitsuaya-ku, Yodogawa-ku, Osaka, Japan 532-0032
E-mail: tom_miya@ballade.plala.or.jp

The use of samarium-doped ceria (SDC) electrolytes in SOFCs (solid oxide fuel cells) lowers the open circuit voltage (OCV) below the Nernst voltage (Vₙ). The OCV is calculated with Wagner’s equation which is included in Nernst-Planck equation. However, using SDC electrolytes requires the verification of leakage currents. Considering the separation of Boltzmann distribution, the fundamental basis of this topic is solved. The OCV using SDC electrolytes is 0.8 V at 1073 K (= 1.15 V -0.7 eV/2e). From Equation 7, the OCV becomes carriers that can escape from the electrolyte. Since the Boltzmann distribution cannot be separated using passive filters, a problem known as the “Maxwell’s demon,” the electrochemical potential should be identical between carriers and non-carriers. Equation 7 was already discovered empirically. As an example, the OCV using SDC electrolytes is 0.8 V at 1073 K (= 1.15 V -0.7 eV/2e). From Equation 7, the OCV is constant during electrode degradation. Consequently, Equation 7 is supported by both the empirical equation and experimental result.

Conclusions
Equation 7 is supported by both the empirical equation and experimental result.

Reference