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Title: Reversible Ageing Behavior of LSM electrodes at Open Circuit

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Description:

LSM remains one of the most popular cathode materials in solid oxide fuel cells because of its long term stability. We describe here an ageing behavior of LSM electrodes which has not, to our knowledge, been reported in the literature. Symmetrical cells with LSM electrodes and YSZ electrolyte were held at 700, 750, 800 and 850^{o}C in air and characterized periodically with cyclic voltammetry and electrochemical impedance spectroscopy to monitor the polarization resistance. The cells remained at open circuit between measurements. Initially, there were irreversible changes in the polarization resistance, most commonly a brief rise and then a significant decay in the polarization resistance. The rate of change increased with the temperature. After the initial conditioning of the cell, the polarization resistance showed a reproducible rise in polarization resistance at 700^{o}C, and a reproducible decay in polarization resistance at 800^{o}C, with the temperature being changed every 2-3 days.

There is considerable discussion in the literature concerning the sharp decrease in polarization resistance of LSM cathodes during the initial application of current. Of the many possible mechanisms, we favor migration of strontium within LSM phase as the cause of the reversible changes in polarization resistance. Strontium segregation (with possible formation of a new phase) is favored at 700^{o}C, while migration of strontium into the bulk occurs at 800^{o}C. The irreversible changes in polarization resistance may be a combination of the cation migration and structural changes in the LSM material (e.g., cracking, de-wetting). Samples of LSM are being analyzed to check for changes in cation surface compositions as a function of thermal history of the LSM electrodes.