Synthesis of Dual Phase Cathodes for IT-SOFCs via Thermal Plasma

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The combinatorial approach is particularly suitable for identification of suitable cathode materials. This involves a simultaneous deposition of thin film cathodes each with a different composition in a single experiment. The composition and microstructure of cathode materials has a large impact on the performance of solid oxide fuel cells (SOFCs). A main goal in SOFC research is the development of cathodes with a sufficiently low electrochemical resistance (~ 0.15 Ω.cm2) at operating temperatures significantly below 800°C. Focus has been shifted to particularly mixed conducting perovskites of the La1-xSrxCoO3—δ (LSC), La1−xSrxMnO3±δ (LSM), LaxSr1−xCoyFe1−yO3−δ (LSCF) family [1]. Since, Crumlin et al.[2] and Sase et al. [3] exhibit improved electrochemical performance with hetero-structures [4]. Oxygen surface exchange was found to be enhanced at the heterointerface of LSC214/LSC113 [3].

It was recently shown that the sputter deposited (La0.8Sr0.2) CoO3 (LSC-113) - (La0.5Sr0.5)2CoO4 (LSC-214) dual phase cathode yield the best performance where the mixture had an amorphous-like structure [5]. In this study a composite cathodes LSC113-LSC214 and LSF-LSM were synthesized via thermal plasma using a large flow rate of quenching gas yielding non-equilibrium cathode powder. The purpose is to see if similar performance improvement could be obtained with plasma synthesized composite powders. The powders were screen printed onto suitable electrolytes and were characterized based on EIS responses using a symmetric cell under air. The typical EIS response at 500 °C is given in Fig 1.

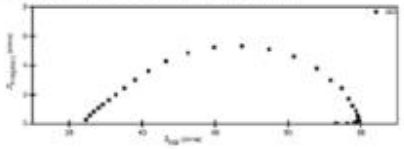

Figure 1. Nyquist plot of LSC-113/LSC-214 cathodes measured at 500°C.

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