Development of polyamorphous cathodes materials for IT-SOFCs

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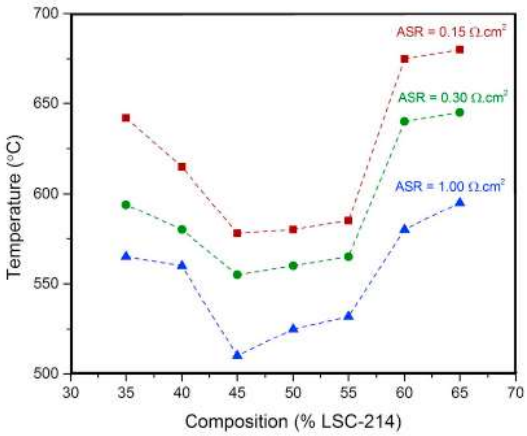
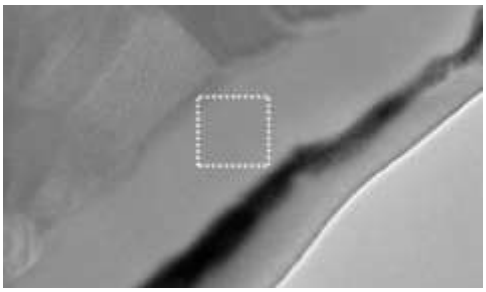
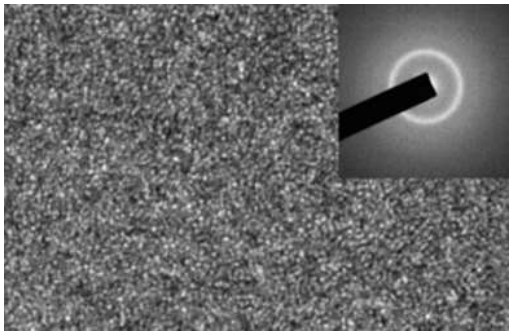
There is a considerable interest in lowering the operating temperature of solid oxide fuel cells. In this respect, (La,Sr)CoO3-(La,Sr)2CoO4 dual phase oxides have attracted much attention as cathode materials due to their enhanced oxygen reduction reaction kinetics[1,2]. Moreover there is much interest to develop these cathodes in amorphous state which not only leads to significantly improved cathode performance, but also are associated with a strong resistance to Sr segregation making them as a suitable choice for IT-SOFCs[3].



Variation of temperature where ASR= 0.15, 0.30 and 1.0 Ω cm2 with composition. Note that temperature is minimum at LSC113- 45%LSC214. (Sari et al 20018)



TEM image of a portion of symmetric cell with LSC113 -50 % LSC214 cathode. Granular region is electrolyte and dotted square shows a portion of a cathode where SAD is taken (Sari et al, 2018)



TEM image of co-sputtered cathode LSC113 -50 % LSC214. Note that in co-sputtered state the cathode is amorphous (Sari et al, 2018)

In the current study so as to further improve the stability, a third oxide was introduced into the system. Over 20 cathodes compositions, all based on (La,Sr)CoO3-(La,Sr)2CoO4-(Gd,Ce)O2 ternary system, were sputter deposited in combinatorial geometry. A target operating temperature of 550oC was selected and the full cell performances were measured in each cell so as to identify the best cathode composition. Scenarios how to best keep the amorphous structure at elevated temperatures and with prolonged use are discussed.

Acknowledgement

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[1] ZÇ Torunoglu, D Sari, O Demircan, YE Kalay, T Ozturk, Y Kuru One pot synthesis of (La, Sr) CoO3/(La, Sr) 2CoO4 for IT-SOFCs cathodes, International Journal of Hydrogen Energy 43 (40), 18642-18649

[2] D Sari, F Piskin, ZC Torunoglu, B Yasar, YE Kalay, T Ozturk Combinatorial development of nanocrystalline/amorphous (La, Sr) CoO3-(La, Sr) 2CoO4 composite cathodes for IT-SOFCs, Solid State Ionics 326, 124-130

[3] D Sari, B Yasar, F Piskin, YE Kalay, T Ozturk Segregation Resistant Nanocrystalline/Amorphous (La, Sr) CoO3-(La, Sr) 2CoO4 Composite Cathodes for IT-SOFCs Journal of The Electrochemical Society 166 (15), F1157A

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