THESIS INFORMATION

Title:	Synthesis of $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF 6428) as cathode material for SOFCs
Major:	Chemical technology of inorganic substances
Code:	62.52.75.01
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Abstract:

LSCF 6428 materials were synthesized by microwave assisted sol-gel processes with complexing agent was EDTA. The results showed that the complex between EDTA and metals have advantages, the success of the modified sol-gel method which was assisted by microwave. Factors that influence this modified process were investigated and the appropriate conditions were selected as follows: the molar ratio of EDTA/ NO_3^- was 1.5; pH was 8.0 ± 0.5; Appling of microwave and stirring were repeated twice: for each time, microwave was powered at 400 W in 5 min and stirring was at 90 ^oC in 1 hour; After that, the material was calcined at 900 ^oC in 1 hour.

The single crystalline phase of LSCF 6428 material product was tested (according to XRD and AAS results). The particle size of this material was in the range of 90 - 120 nm (according to SEM and TEM results) and specific surface area reached 13.384 m^2/g (according to BET results in N_2 gas). Thus, the modified synthesis process has obtained the desired product, save the time and energy than traditional sol – gel.

To improve the properties of the material, LSCF 6428 was mixed with GDC at different mixing ration. The results showed that making cathode from composite at the ratio of 7:3 (w/w) was suitable because of the TEC matching with electrolyte. It resulted in the high porosity (27.68 ± 0.22 %), low CH_4 conversion (20.4 – 24.8 %) and low resistance (0.17 to 0.20 Ω) of the composite.

The influence of activated carbon to the porosity of the cathode was then investigated. When 5.0 % activated carbon was mixed into the composite, the porosity of the mixture was increased from 27.68 to 30.03 %. At the same time, the TEC of this new composite cathode is unchanged that still thermally matches with the electrolyte. Also, the conversion decreased slightly which would reduce the fuel consumption. However, there was a slight increase of the resistance which led us not to continue increasing the ratio of carbon but to select the ratio of 5.0 %.

The activity of the cathode was investigated for 72 hours, at the reaction temperature of 700 °C. The resistance of the cathode during this operation changed insignificantly. After the operation, XRD and SEM analyses for the cathode were performed, together with the test of its porosity. The results showed the stability of cathode properties which had been maintained during survey times.

The main contributions of the thesis:

(1) Improved LSCF 6428 synthesis process by microwave assisted sol-gel to save time and energy;
(2) Surveyed characteristics of this material as cathode at medium temperature;
(3) Created a cathode composite to improve SC-SOFC capacity;
(4) Selected the proper operations for SC-SOFC.

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