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LSCF fibers for IT-SOFCs applications: synthesis and morphological analysis

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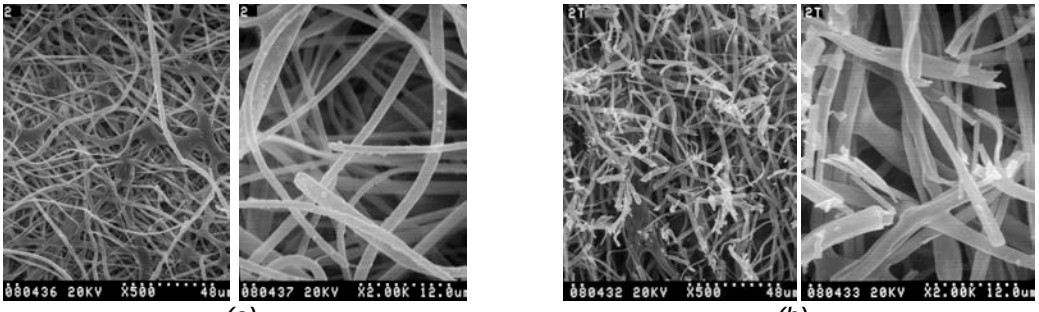
The electrospinning technique offers several advantages for IT-SOFC applications: the large variety of 1D-structures that could be obtained allows to tailor the microstructure of the electrode which gets unique properties, such as high surface area, porosity and continued charge transfer pathways. At the same time, coupling the electrospinning technique with infiltration methods, high electrode performance can be reached even at intermediate temperatures, since this kind of structures can accommodate large amounts of infiltrations.

We have investigated the tailoring of the electrode microstructure and the content and distribution of infiltrated particles both from an experimental and a modelling point of view. We have synthesized $La_{1-x}Sr_xCo_{1-y}Fe_yO_{3-\delta}$ (LSCF) fibers through the electrospinning method. We have investigated the formation of nanofibers as function of the operating parameters, i.e. the applied voltage, the solution properties and feeding rate. The influence of these parameters on the fibers morphology has been examined, as well as the effect of the sintering procedure. Figure 1 below displays our LSCF electro-spun fibrous scaffolds. The fibers, initially of diameter around 500nm (Figure 1a), are broken by heat treatment, resulting similar to nanorods (Figure 1b).

We have investigated from a modelling point of view the effect of infiltrations on LSCF fibers and we have analyzed the electrochemical properties and performance of the electrode depending on the infiltration loading. LSCF is a mixed ionic electronic conductor (MIEC), and thus the fibrous scaffold provides continuous pathways for both electrons and oxygen ions through the SOFC electrode. Despite this, literature experimental results show that its performance as an electrode material is rather low (overall electrode resistance $R_p \approx 4x10^{-4}\,\Omega m^2$ at 863K), unless it is infiltrated with dopant materials, such as Gd- and Sm-doped Ceria (GDC and SDC respectively).

Our model results, together with our preliminary experimental data, show that fibrous ceramic materials, synthesized through electrospinning and infiltrated with GDC particles, display interesting features for application in IT-SOFCs.



(a) *(b)*

Figure 1: *SEM images of LSCF electro-spun scaffolds before (a) and after (b) the heat treatment*

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