Active layers based on vertically aligned nanostructures for SOFC applications

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One of the most recent strategies to enhance the electrode performance is preparing composite materials leading to an increase of the triple-phase-boundary (TPB) length. In this work, thin films VANs based on $(La_{0.8}Sr_{0.2})_{0.98}Fe_{0.8}Ti_{0.2}O_{3-\delta}$-$Ce_{0.9}Gd_{0.1}O_{1.95}$ (LSFT-GDC) deposited by PLD were obtained for their use as functional layers in Solid Oxide Fuel Cells (SOFCs).

EXPERIMENTAL/THEORETICAL STUDY

LSFT-GDC and LSFT films were deposited onto STO, YSZ and LSAT (001) single cristals at 650 ºC in a surface PLD. The crystal structure and microstructure of the active layer were characterized by XRD, AFM and electron microscopy techniques. In-plane conductivity of the samples was studied by four-probe Van der Pauw method to obtain the total conductivity of the samples.

RESULTS AND DISCUSSION

XRD patterns revealed that two different crystalline phases are clearly discernible. In addition, the cell parameters of the LSFT and CGO phases are similar to those reported for thein the literature. It has to be noted that an epitaxial growth on the (001) direction for both phases was observed for the samples deposited on STO and LSAT. STEM image and EDS elemental mapping showed alternant nanocolumns of 5 nm of each phase and HR-TEM images confirmed that the columns are well defined and showed high crystallinity (Fig. 1).

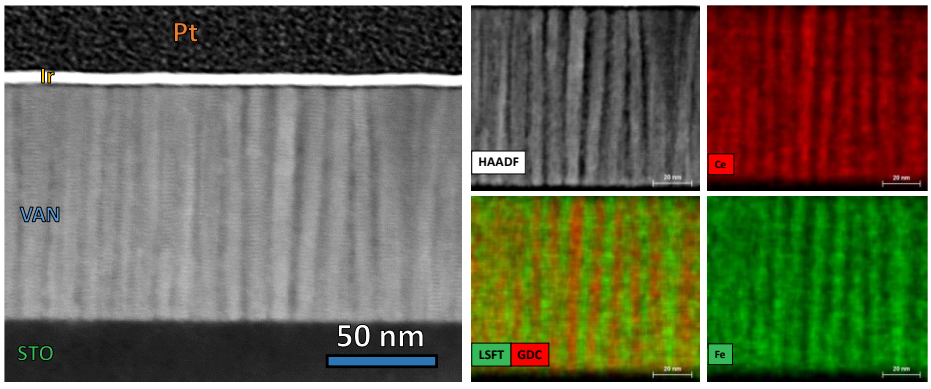

Fig. 1 HR-TEM images of the LSFT-GDC vertically aligned nanocomposite electrodes.

The area specific resistance (ASR) of the electrodes in symmetrical cells was determined by impedance spectroscopy in air, diluted and pure hydrogen obtaining ASR values as low as 1 Ω·cm² at 650 ºC in air, being these values one of the lowest reported for thin films for SOFC applications.

REFERENCES

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