Impedance measurements of LSM-YSZ-YSZ/Ni assemblies

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YSZ is used as solid electrolyte in different applications like fuel cells, sensors, oxygen generators. Research interest for these applications aims to reduce working temperature to an intermediate range of less than 700°C.

We have used atmospheric plasma spraying to produce LSM-YSZ-YSZ/Ni assemblies in one technological step. An YSZ-Ni film, approximately 600 µm thick was sprayed as support anode, followed by the deposition of the YSZ-electrolyte, with a thickness of about 100 µm. A 100 µm LSM cathode film was deposited in the last step. To improve the porosity of the cathode material different contents of polymer were added to the LSM powder. A final heat treatment at 500°C / 2 h was applied to remove the polymer residues.

The SEM microstructure analyses showed that the electrode materials have good porosity and a high surface roughness, depending on the plasma spraying process. The electrodes and the electrolyte material show good adhesion. Micro-composition analyses were made by EDX. It was shown that the composition of the electrolyte was 8%Y_2O_3 in ZrO_2. The composition of the LSM powder was confirmed.

Electrical properties of the assemblies were characterized by Impedance Spectroscopy measurements, at temperatures between 350 and 650°C in air (Fig.1), and at different oxygen concentrations (in N_2) (Fig.2). The results demonstrate that the electrolyte resistivity decrease with temperature increase. The polarisation frequency of the electrodes increased in the same temperature range, showing a typical Arrhenius behaviour of the ion conductivity mechanism (Fig.3).

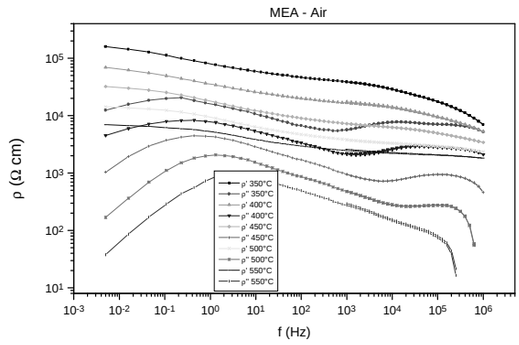

Fig.1. Complex resistivity of the LSM-YSZ-YSZ/Ni assemblies depending on temperature

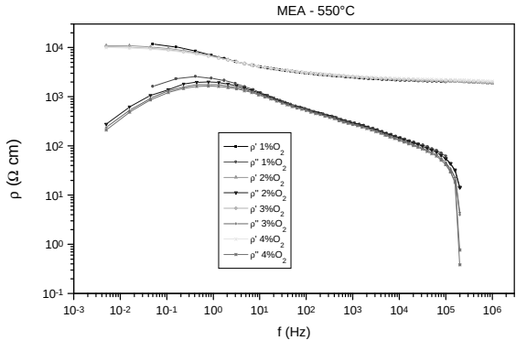

Fig.2. Complex resistivity of the LSM-YSZ-YSZ/Ni assemblies depending on oxygen concentration

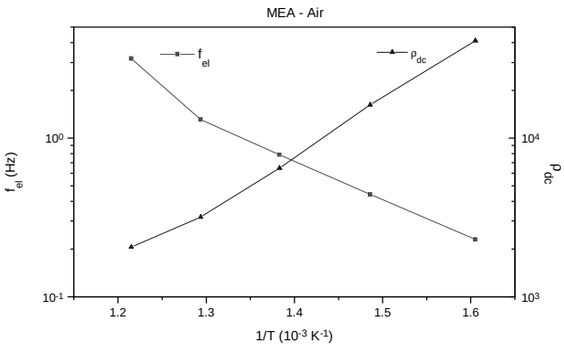

Fig.3. Electrolyte resistivity and polarization frequency *vs.* temperature