Application 2039

Study of electrosprayed deposited CCMs for PEMFC

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The work to be carried out under this program is related to the study of catalyst coated membranes (CCM) prepared by the electrospray technique. The electrospray technique is based on the deposition of a solid material in a suspension under the influence of an intense electric field. It has been used by our group for several years for the preparation of catalyst layers for electrodes and CCMs of proton exchange membrane fuel cells (PEMFCs). The results obtained with the electrospray prepared components have shown improved performance in single cells, ascribed to the special properties of electrospray deposited catalyst layers: larger specific area of the catalyst, improved interaction of the ionomer with the platinum catalyst, and optimal porosity and mass transport properties of the layers.

Access to research and testing facilities through the H2FC project would provide additional information to the work that the Low Temperature Fuel Cells group of CIEMAT is carrying out in the subject of electrospray preparation of PEMFC components. In particular the instrumented single cell test facility at NPL dedicated to PEMFC research with in situ measurement techniques will help in studying durability and degradation modes of electrosprayed catalyst layers, under conditions such as startup/shutdown and cell reversal. The in situ measurement of relative humidity in PEMFC flowfield channels and localised potential measurement will give additional information about current distribution homogeneity and water transport.

With this aim, the following working tasks are proposed:

Task 1.- Preparation of CCMs using the electrospray technique. The CIEMAT group will prepare a series of CCMs with variable Pt/C ratio, 20%, 40% and 60% in the cathode, maintaining the same catalyst load (0.25 mg·cm-2) and ionomer content (15 wt%). The anode side will be a standard electrode in order to compare cathodic behaviour. A total of six CCMs (two each type) will be fabricated. The geometrical dimensions of the CCMs, shapes, as well as the number of samples, will be in accordance with the laboratory at NPL, to fit their standard single cell hardware.

Task 2.- Single cell mounting and characterization of CCMs. CCMs together with other requested material for mounting single cells (commercial electrodes for comparison) will be

sent from CIEMAT to NPL. A representative from CIEMAT may also visit NPL facilities to assist in this task. Testing will include I-V curves, electroactive area measurements, startup/shutdown cycles, voltage reversal degradation, localised potential and localised humidity measurements.

Task 3.- Discussion of results, report. Results will be discussed jointly by the NPL and the CIEMAT groups. A report will be issued. In the case that results represent a new contribution to the present knowledge on the behaviour of electrosprayed components, they may be included in a joint publication to be sent to an international journal.