Ordered 2D nano-porous polymeric matrices for nano-structured membranes based on polymers, zeolites and ionic liquids.

Authors & affiliations:
Mauro Sgroi, Elena Bortolotti, Belforte Luca, Vito Guido Lambertini, Alina Pruna
Centro Ricerche FIAT (Strada Torino 50, 10043 – Orbassano (TO), Italy)
Corresponding Author: mauro.sgroi@crf.it

Abstract:
One of keys of success of PEMFC technology is the development of improved and mass manufacturable electrolyte membrane materials that can operate at a temperature range of 130-200°C since it has been proved that, operating at T>120°C can overcome most of the functional problems currently associated with PEMFC.

EOCELL project will develop a nano-structured electrolyte membrane based on a new composite multifunctional material made by the synergic combination of zeolites, ionic liquids and polymers.

The structure of the targeted electrolyte membranes will consist of:

- A 2D micro-structured polymeric matrix with ordered or random nano-porous filled up with ionic liquids;
- Two Nano-structured zeolitic membranes at the top and the bottom of the polymer matrix.

The 2D ordered nano-porous polymer structures must possess a controlled thickness (between 15-150 microns) and pore size (60-500 nm) and have to be capable to withstand temperatures up to 200°C.

The selected technique for the preparation of the 2D polymeric matrix is X-ray lithography which has unique and excellent features, such as fine pattern fabrication capability, an extremely large effective depth of focus. X-Ray masks will be constructed using Anodic Porous Alumina (APA) membranes filled with metals characterized by high absorption coefficients. This approach allows to build large area lithographic masks, otherwise impossible to obtain with other techniques. The method is based on the fact that amorphous alumina obtained by the anodic process, having a very low density, is quite transparent to X-Rays.

The APA based lithographic process requires the selection of a negative photo-resist. On the basis of the required specifications, the SU-8 negative epoxy photo-resist, characterized by excellent chemical and thermal stability, was selected.

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