Researchers make progress in optimizing solid oxide fuel cells

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While our standard of life increases, so does the worldwide energy demand. In this vein, the application of technologies based on fuel cells is put forward as an alternative to the massive consumption of fossil fuels. One of the fuel cells of greatest current interest is the solid oxide one.

The PhD thesis by researcher at the University of the Basque Country (UPV/EHU), Ms Ana Martínez Amesti, focused on optimising solid oxide fuel cells, one of the most promising technologies of the future for various applications (residential, commercial, portable devices, electric power stations, and so on). The author has entitled her thesis Solid oxide fuel cells. Studies on reactivity and optimisation of cathode-electrolyte interlayer.

Solid oxide fuel cells are the type of cells most studied in recent years. They have basically two outstanding characteristics: the electrodes and the electrolyte are solid and the versatility in the choice of fuels and oxidants due to high operational temperatures. As regards problems arising with this kind of cell, there are also two important ones: on the one hand, the difficulties in manufacturing, given that the ceramic materials of which they are made require high temperatures for their processing and, on the other, in some cases, the solid electrolyte degrades easily at the cell's working temperature, thus affecting its stability.

Thus, the principal alternative for achieving the economically viable

marketing of solid oxide fuel cells is to reduce their operating temperature. In this way, one of the requisites is having mixed conducting materials that can be used as cathodes at operating temperatures of between 550ºC and 800ºC.

Ms Martínez has studied the problem that presents mixed oxides employed in solid oxide fuel cells, given that these materials react on occasions with the electrolyte, diminishing the power of the cathodes. As a solution to this problem, Ms Martínez proposed including an interlayer between the material employed as a cathode and the electrolyte, with the objective of reducing the solid state reactions taking place and, thus, improving the electrochemical response of the system. According to the PhD author, the introduction of an interlayer between the cathode and the electrolyte considerably enhances the conducting properties of all the cathodes.

This precisely has been one of the main objectives of this research work: the study of the processes that occur in at the electrolyte-cathode interphase. Once these interactions were investigated, a process of optimisation of the interlayer parameters was carried out, such as the microstructure, porosity and thickness. Finally, Ms Martínez undertook basic research on durability, aimed at determining the degradation suffered by the cells studied with temperature and time of exposition.

Source: Elhuyar Fundazioa