OXYGEN-PERMEABLE CERAMIC MEMBRANES: KEY MATERIALS, SELECTED PROCESSING METHODS, MODELING AND PERFORMANCE

Naumovich E.[1], Yaremchenko A.[1], Shaula A.[2], Viskup A.[3], Kovalevsky A.[4], Tsipis E.[5], Pankov V.[3], Kharton V.[1]

[1] *Ceramic and Glass Eng. Department, University of Aveiro, Aveiro, Portugal*
[2] *Department of Mechanical Engineering, ICEMS, University of Coimbra, Coimbra, Portugal*
[3] *Research Institute For Physical Chemical Problems, Belarus State University, Minsk, Belarus*
[4] *Materials Department, Flemish Institute for Technological Research (VITO), Mol, Belgium*
[5] *Chemistry Department, ITN/CFMC-UL, Sacavém, Portugal*

Technologies for high-purity oxygen separation from air and partial oxidation of light hydrocarbons using dense ceramic membranes with mixed oxygen-ionic and electronic conductivity have high potential for the gas and energy industries. However, commercialization of such devices requires meeting of often incompatible goals, namely a high oxygen permeability, chemical stability and moderate thermal expansion for both oxidizing and reducing conditions, respectively encountered at the membrane feed and permeate sides. While the search for novel materials with improved transport and mechanical properties is still a major challenge, research effort was also directed towards optimization of the membrane architecture. This report is focused on the comparative analysis of specific oxygen permeability, thermal and chemical expansion, thermodynamic and kinetic stability, and catalytic activity in the several groups of mixed-conducting materials, including La_2NiO_4-, (La,Sr)CoO_3-, (La,Sr)FeO_3- and $LaGaO_3$-based solid solutions and their derivatives. Attention is also centered on the composite materials, ceramic processing, membrane optimization and surface activation methods, long-term stability issues, and phenomenological modeling of oxygen transport processes in the ceramic membranes with different architecture.