H₂ purification through BaCe₀.₆₅Zr₀.₂₀Y₀.₁₅O₃₋ΔCe₀.₈₅Gd₀.₁₅O₂₋Δ ceramic dual-phase membrane

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BaCe₀.₆₅Zr₀.₂₀Y₀.₁₅O₃₋ΔCe₀.₈₅Gd₀.₁₅O₂₋Δ (BCZ20Y15-GDC15) dual-phase material is currently one of the most promising dense ceramic membrane for H₂ separation and purification at T > 600 °C. Indeed, this composite material reached H₂ permeability values among the highest ever reported for mixed protonic and electronic conductor (MIEC) membranes (≥ 0.3 mL·min⁻¹·cm⁻² at 750°C). ¹, ² A selective H₂ separation and purification is allowed through BCZ20Y15-GDC15 membrane by incorporating it into the crystal structure of its constituents as charge protonic defects and electrons/holes that are transported to the opposite side of the membrane under a H₂ partial pressure gradient, thus providing a non-galvanic separation, i.e. without external power. ³ Besides the H₂ permeability performances, it shows also a good chemical stability under harsh reducing conditions and under CO₂- and H₂S- containing atmospheres. ⁵, ⁶ This talk provides a comprehensive overview of the recent results reached by our group in such MIEC material for H₂ separation. The preparation method, hydrogen permeability and long-term stability of the BCZ20Y15-GDC15 composite system under reducing harsh environments will be discussed. In-situ synchrotron XRD analyses under H₂ atmospheres will be also shown.

References

Acknowledgements: This work has been funded by the Italian National Research Council – Italian Ministry of Economic Development agreement 2016-2018 “Ricerca di Sistema Elettrico Nazionale.”