Poster

# Enhancing SOFC Anode Performance through Cerium and Nickel Doping in $PrBaMn_2O_{5+\delta}$ Structures

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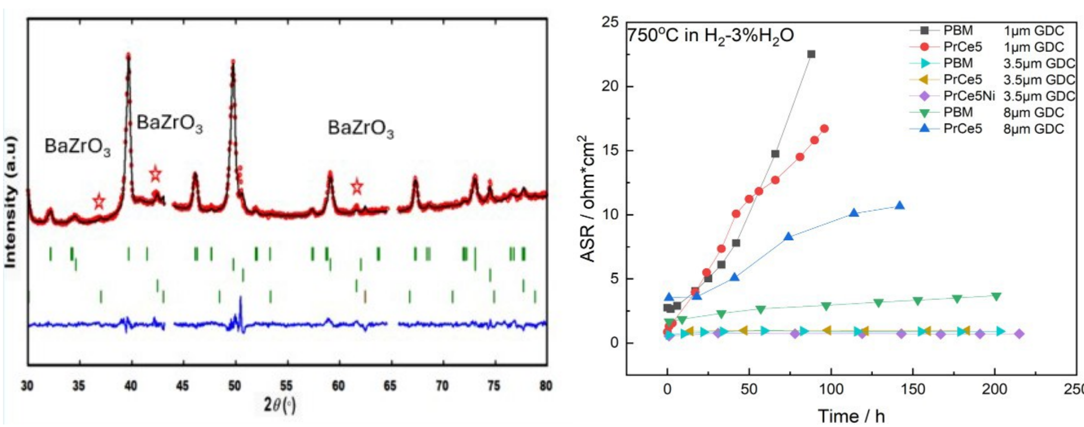
The performance and durability of solid oxide fuel cells (SOFCs)[1] are paramount for their successful application in sustainable energy technologies. This study examines the impact of introducing cerium and nickel[2,3] into the $PrBaMn_2O_{5+\delta}$ (PBM) structure and investigates the influence of gadolinia-doped ceria (GDC) buffer layer thickness, applied via physical vapor deposition, on anode performance. We synthesized various $Pr_{1-x}Ce_xBaMn_2O_{5+\delta}$ compositions and a nickel-doped variant, testing these under $H_2$-3% $H_2O$ reducing conditions typical of SOFC operations. Employing a combination of temperature-dependent *in situ* neutron diffraction, electrochemical impedance spectroscopy (EIS), and microstructural analyses, this research aims to uncover how doping strategies and variations in GDC layer thickness affect the physical and electrochemical properties of the anodes. Preliminary observations indicate enhancements in thermal compatibility and reductions in area-specific resistance, suggesting substantial modifications to the anode's behavior.[4] These findings will be discussed in detail during the presentation, offering valuable insights into the optimization of anode materials for enhanced SOFC performance, emphasizing the roles of targeted elemental doping and optima GDC layer thickness.




(a) (b)

**Figure 1.** (a) Neutron diffraction pattern at 900 °C for the $PrCeBaMn_2O_5$-YSZ composite, evidencing the formation of the $BaZrO_3$ impurity. (b) Impact of GDC buffer layer thickness on ASR performance over time for PBM, PrCe5 and PrCe5Ni anodes.

[1] Ormerod, R. M. Solid oxide fuel cells. *Chem. Soc. Rev*. 2003, 32(1), 17−28.

[2] Bahout, M.; Managutti, P. B.; Dorcet, V.; Le Gal La Salle, A;Paofai, S.; Hansen, T. C. In situ exsolution of Ni particles on the $PrBaMn_2O_5$ SOFC electrode material monitored by high temperature neutron powder diffraction under hydrogen. *J. Mater. Chem. A,* 2020, 8 (7), 3590−3597.

[3] Praveen B. Managutti, Simon Tymen, Xiu Liu, Olivier Hernandez, Carmelo Prestipino, Annie Le Gal La Salle, Sébastien Paul, Louise Jalowiecki-Duhamel, Vincent Dorcet, Alain Billard, Pascal Briois, and Mona Bahout, Exsolution of Ni Nanoparticles from A-Site-Deficient Layered Double Perovskites for Dry Reforming of Methane and as an Anode Material for a Solid Oxide Fuel Cell, *ACS Appl. Mater. Interfaces* 2021, 13, 30, 35719–35728

[4] Praveen B. Managutti, Yeting Wen, Thomas C. Hansen, Vincent Dorcet, Serge Paofai, Pascal Briois,Kevin Huang, and Mona Bahout, Ce- and Ni-Codoped Double PrBaMn2O5 Perovskite as a Ceramic SOFC Anode, *ACS Appl. Energy Mater*. 2024, 7, 3831−3840.