ALCOHOLS OXIDATION OVER CoNb AND CoCe OXIDE-BASEDCATALYST SUPPORTS

Virginija Kepenienė[1], Raminta Stagniūnaitė[1], Jūratė Vaičiūnienė[1], Loreta Tamašauskaitė-Tamašiūnaitė[1]

[1]Center for Physical Sciences and Technology, Department of Catalysis, Vilnius, Lithuania
virginija.kepeniene@ftmc.lt

Growing environmental concerns, depletion of fossil fuels, and the demand for clean energy technologies have intensified interest in efficient and sustainable energy conversion systems. Alcohol fuel cells are considered promising alternatives due to their high energy density, low operating temperatures, ease of fuel storage, and near-zero harmful emissions [1-3]. The performance of alcohol fuel cells strongly depends on the activity, stability, and durability of the catalytic materials employed for alcohol oxidation reactions [1-3].

In this work, platinum-supported Co–Nb/C and Co-Ce/C catalysts were prepared by microwave irradiation heating to achieve uniform metal dispersion and enhanced metal–support interactions. Combintion Co–Nb and Co–Nb oxides as a supports contributed to improved catalytic performance and structural stability of prepared catalysts. The morphology and composition of the prepared catalysts have been investigated using X-ray diffraction (XRD), field-emission scanning electron microscopy (FE-SEM), and inductively coupled plasma optical emission spectroscopy (ICP-OES). Cyclic voltametry was used for investigation of PtCo–Nb/C and PtCo-Ce/C as electrocatalysts for ethanol, methanol and ethylene glycol oxidation.

The obtained results showed that the PtCo–Nb/C catalyst exhibits approximately twofold higher electrocatalytic activity toward alcohol oxidation reactions compared with the PtCo–Ce/C catalyst, highlighting the importance of catalyst design in developing efficient, low-emission energy technologies for future sustainable power generation.

[1] M. H. Nazir et al., “Liquid Metal Electrocatalyst with Ultralow Pt Loading for Ethanol Oxidation,” Small Science, vol. 5, no. 1, p. 2400370, Oct. 2024, doi: 10.1002/smsc.202400370.

[2] D. K. Madheswaran, M. Thangamuthu, S. Gnanasekaran, S. Gopi, T. Ayyasamy, and S. S. Pardeshi, “Powering the Future: Progress and Hurdles in developing proton Exchange membrane fuel cell components to Achieve Department of Energy Goals—A Systematic Review,” Sustainability, vol. 15, no. 22, p. 15923, Nov. 2023, doi: 10.3390/su152215923.

[3] M. Hren, M. Božič, D. Fakin, K. S. Kleinschek, and S. Gorgieva, “Alkaline membrane fuel cells: anion exchange membranes and fuels,” Sustainable Energy & Fuels, vol. 5, no. 3, pp. 604–637, Nov. 2020, doi: 10.1039/d0se01373k