Surface reconstruction on RhPt/C nanoparticles applied to methanol oxidation in acid and alkaline media

Caio V. S. Almeida[1], Stephany D. dos Santos[2], Nelson A. Galiote[3], Katlin I. B. Eguiluz[4], Giancarlo R. Salazar-Banda[4], Vinicius Del Colle[5*], G. Tremiliosi-Filho[3]

[1] Federal University of São Carlos, [2] Federal University of Alagoas, [3] Chemistry Institute of São Carlos – USP, [4] Tiradentes University, [5] Aeronautics Technological Institute

**e-mail: delcolle@ita.br*

Rh–Pt alloys exhibit remarkable activity and stability in both acidic and alkaline environments, making them promising candidates for methanol oxidation in fuel cells. The strategic combination of rhodium (Rh) and platinum (Pt) plays a crucial role in mitigating carbon monoxide (CO) poisoning and enhancing catalytic efficiency. This study provides new insights into the morphological changes occurring on the surface of these catalysts during electrochemical reactions. Using a range of electrochemical techniques, we thoroughly evaluated the performance and stability of Rh–Pt/C nanoparticles in acidic and alkaline media. Our findings reveal that after 100 voltammetric cycles in methanol, a significant surface reconstruction occurs, leading to increased exposure of Pt atoms [1]. This surface restructuring is strongly influenced by the nature of the electrolyte. In acidic media, the effect is more pronounced due to differences in surface energy between the metals. In contrast, the higher concentration of hydroxyl species in alkaline media appears to hinder the segregation of Pt atoms to the catalyst surface. These findings contribute to a deeper understanding of Rh–Pt alloy behavior in fuel cell environments and may guide the development of more efficient and durable catalytic systems.

Acknowledgments:

FAPESP (#2019/22183–6) and CNPq (#3134455/2021-0, #408069/2022-8, and #312788/2022–3).

References:

[1] Nelson A. Galiote, Camilo A. Angelucci, Vinicius Del Colle and Germano Tremiliosi-Filho, *Electrochimica Acta*, 526, 146084 (2025).