Electrocatalytic Mechanisms of High Power, High Energy Density Alkaline Fuels

David A. Finkelstein,[1*] Régis Imbeault,[1*] Eric D. Rus,[2*] Ryo Wakabayashi,[2] Abigail R. Van Wassen,[2] Héctor D. Abruña,[2] Daniel Guay[1]

[1]Institut National de la Recherche Scientifique: Énergie, Matériaux, et Télécommunications
1650 Blvd. Lionel-Boulet,
Varennes, QC J3X 1S2, Canada

[2]Cornell University, Dept. of Chemistry and Chemical Biology, Physical Sciences Bldg.,
Ithaca, NY 14850, U.S.A.

[*]These authors contributed equally

Alkaline conditions allow the use of highly reactive, high energy density fuels, such as borohydride (BH_4^-), which quickly decompose in acid. Such fuels possess the gravimetric (specific) and volumetric energy densities of methanol and ammonia while delivering current densities several orders of magnitude higher, increasing power density and decreasing Pt loading. Additionally, these fuels perform well at select non-Pt catalysts, opening important avenues for fuel cell cost reduction. The electrocatalytic mechanisms of such fuels have been explored at a variety of catalysts and important trends and predictors of catalysis have been elucidated. These experimental findings are compared to current theoretical predictions and understanding.