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2021 WORLD FUEL CELL CONFERENCE

AUGUST 17-20, 2021 | WATERLOO, CANADA

Name	Marc Secanell
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Invited Keynote Lecture

Presentation Title	**Transient, multi-phase analysis of polymer electrolyte fuel cells: Insights from computational modeling at multiple scales and experiments**
Abstract (Approximately 200 words)	Polymer electrolyte fuel cell (PEFC) vehicles have already met most customer requirements including long range, quick refuelling and start-up at sub-zero temperatures. However, PEFCs are still too expensive for large scale commercialization, and further cost reductions could be achieved by operating at higher current densities at reduced Pt loading. High current density operation results in increased water production that accumulates over time in the porous cell structure, blocking fuel and reactant transport and shutting down the cell. In order to analyze fuel cell architectures and strategies that mitigate accumulation in PEFCs, pore level imaging, analysis and simulation tools to study gas and liquid transport; and, volume-averaged transient PEFC models have been developed in the open-source software OpenFCST (www.openfcst.org). These tools can now be used to predict how water accumulates in varying electrode microstructures, and combined to generate a comprehensive numerical model that accounts for water accumulation over time at multiple spatial scales. This presentation aims at highlighting these recent advances in simulation tools and how, when combined with detailed experimental validation, they can be used to gain insight into the physical processes inside the fuel cell, such as water accumulation in catalyst layer with varying pore size distribution, water dynamics in the membrane, the role of microporous layers on mitigating water accumulation in the electrode, and the effect of H_2 cross-over on reducing the open cell voltage of low loading platinum electrodes.
Biographical Sketch (Approximately 200 words)	**Marc Secanell** is a Professor at the University of Alberta, Canada. He received his Ph.D. (2008) and M.Sc. (2004) from the University of Victoria, Canada, and B.Eng. (2002) from the Universitat Politècnica de Catalunya (BarcelonaTech). His research interests are in the areas of: a) analysis and computational design of energy systems, such as PEFCs, polymer electrolyzers, flywheels and cooling towers; b) fabrication and characterization of PEFCs and electrolyzers; c) finite element analysis; and, d) multidisciplinary design optimization. His current research projects include the development of the open-source fuel cell simulation toolbox (OpenFCST), an open-source framework for analysis and design of electrochemical energy systems, and the fabrication and characterization of low loading PEFCs and electrolyzers. He has been invited speakers at prestigious conferences such as the Electrochemical Society Meeting and the Gordon Research Conference in Fuel Cells. He is the co-chair of the 2022 GRC Fuel Cell conference.