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Gasteiger, H.A, Kocha, Shyam S., Sompalli, Bhaskar, and Wagner, Frederick T. *Activity Benchmarks and Requirements for Pt, Pt-Alloy, and Non-Pt Oxygen-Reduction Catalysts for PEMFCs*, Applied Catalysis B., Environmental, volume 56, issues 1-2, 10 March 2005, pp 9-35 http://www.sciencedirect.com/science/article/pii/S0926337304004941

> **Key takeaways:** Prospects for potential platinum-alloy catalysts - potential materials, performance goals needed for automotive application, benchmark oxygen-reduction activities, and testing procedures. Behaviors of some non-platinum catalyst materials are also considered

Gasteiger, H.A, Panels, J.E., and Yan, S.G. *Dependence of PEMFC Fuel Cell Performance on Catalyst Loading*, Journal of Power Sources, volume 127, issues 1-2, 10 March 2004, pp 162-171
http://www.sciencedirect.com/science/article/pii/S0378775303009480

> **Key takeaways:** Anode catalyst loading in *state-of-the-art* membrane electrode assemblies operating on pure H2 can be reduced to 0.05 mg_{Pt}/cm^2 without significant voltage losses. If the cathode catalyst loading on an optimized MEA is reduced from 0.40 to 0.20 mg_{Pt}/cm^2, the cell voltage loss is about 10 - 20 mV, consistent with purely kinetic losses due to the oxygen reduction reaction. For reformate/air operation, the anode may have a catalyst loading of 0.20 mg_{PtRu}/cm^2 for reformate containing 100 ppm CO with a 2% air bleed, but the loading cannot be lowered from there without a change in operating conditions

Harvey, D., Pharaoh, J.G., and Karan, K. *A Comparison of Different Approaches to Modelling the PEMFC Catalyst Layer*. Journal of Power Sources volume 179, issue 1, 15 April 2008, pp 209 - 219. http://www.sciencedirect.com/science/article/pii/S0378775307028388

> **Key takeaways**: The cathode catalyst layer of a PEMFC can be modeled using a three-dimensional CFD model and three different approaches: a thin-film model, a discrete-catalyst volume model, and an agglomerate model. The agglomerate model is best at showing the mass transport limitations which occur at higher current densities. The thin-film model over-predicts the current density and exaggerates the variations in current density

Yu, Xingwen, and Yu, Siyu: *Recent Advances in Activity and Durability Enhancement of Pt/C Catalytic Cathode in PEMFC: Part I: Physico-Chemical and Electronic Interaction between Pt and Carbon Support, and Activity Enhancement of Pt Catalyst*, and *Part II: Degradation Mechanism and Durability Enhancement of Carbon-Supported Platinum Catalyst*, Journal of Power Sources, volume 172, issue 1, 11 October 2007, pp 133-154

http://www.sciencedirect.com/science/article/pii/S0378775307015327 and
http://www.sciencedirect.com/science/article/pii/S0378775307015339

Key takeaways: The first paper studies the physico-chemical and electronic interactions between platinum and carbon during the formation of the PEMFC catalyst, and ways that catalytic activity may be enhanced by studying these interactions. The second papers covers ways to stabilize Pt/C cathode catalysts, to keep them from corroding and degrading quickly

Pukrushpan, J. T., Peng, H., & Stefanopoulou, A. G. (2004). Control-Oriented Modeling and Analysis for Automotive Fuel Cell Systems. *Journal of Dynamic Systems, Measurement, and Control, 126*(1), 14. doi:10.1115/1.1648308

Key takeaways: Investigates the control of fuel cell systems by defining fluid dynamics through multiple subsystems, membrane humidity, and pressure changes throughout the system. Breaks into separate submodels that have thorough background in each region. Model based in certain ideal or assumed static conditions that may not necessarily be true.

Zheng, L., Srouji, A., Gambini, F., & Mench, M. (2011). Exploration of Ultra-High Current Operation in PEFC Using a Validated Model. doi:10.1149/1.3635557

Key takeaways: VERY similar to what we are looking to accomplish, although material properties and cell structure has been decided and fixed in this instance. Provides all material, heat, and momentum transport equations and relative boundary conditions (assuming the given cell make-up) to model cell efficiency.

Gurau, V., Mann, J. A., & Zawodzinski, T. A. (2006). Numerical Investigation of Water Transport in the PEMFC Components. *ECS Transactions*. doi:10.1149/1.2356229

Key takeaways: Numerical methods are devised to understand water transport phenomena within the fuel cell, taking into account electro-osmotic drag as well as a multi-phase, multi-fluid system. This could be useful for input equations into the model.

Berg, P., Promislow, K., St. Piette, J. Stumper, J & Wetton, B. (2004, January 26). Water Management in PEM Fuel Cells. *Journal of the Electrochemical Society, 151*(3), A341-353.

Key takeaways: Presents a simplified model for the transportation of water inside a PEM fuel cell. This paper describes nonequilibrium kinetics of the interface between the membrane and the catalyst and explains why these kinetics are fundamental to modeling a fuel cell. Should be useful in modeling fluid transport in the cell.

Koido, T., Furusawa, T., Moriyama, K., & Takato, K. (2006). Two-phase Transport Properties

and Transport Simulation of the Gas Diffusion Layer of a PEFC. *Fundamental Research Center, Honda R&D, Co. Ltd. doi: 10.1149/1.2356163.*

Key takeaways: Describes multiple analysis methods to simulate liquid-gas transport in the gas diffusion layer of the a fuel cell. Provides predictions and measurements of flows in the GDL. Can help us model the transport of fuels through the GDL of a cell.

A.A. Kulikovsky, Optimal shape of catalyst loading along the oxygen channel of a PEM fuel cell, Electrochimica Acta, Volume 54, Issue 27, 30 November 2009, Pages 7001-7005, ISSN 0013-4686

Key takeaways: Defines PEMFC model and derives equation for the optimal shape of cathode catalyst loading to increase current uniformity in the cell. Current inhomogeneity wears down PEMFC parts at an accelerated rate.

Wonseok Yoon, Adam Z. Weber. Modeling Low-Platinum-Loading Effects in Fuel-Cell Catalyst Layers J. Electrochem. Soc. 2011 158(8): B1007-B1018; doi:10.1149/1.3597644

Key takeways: Describes impact of film resistance on oxygen transport in low platinum loading cathode catalyst layer PEMFCs. Defines model using transport equations. Can help us define what are loading concentrations are and should be useful when modeling fluid transport.