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2021 WORLD FUEL CELL CONFERENCE

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Name	Piotr Zelenay	
Affiliation	Los Alamos National Laboratory	
<h2 style="color: red;">Invited Plenary Lecture</h2>		
Presentation Title	Durability of PGM-Free ORR Catalysts: Recent Progress	
Abstract (Approximately 200 words)	<p>While the electrocatalytic activity of platinum group metal-free (PGM-free) catalysts for oxygen reduction reaction (ORR), in particular those obtained through the widely used high-temperature treatment approach, has reached levels close to practical (at high catalyst loadings), their durability under the operating conditions of the polymer electrolyte (PEFC) fuel cell cathode has continued to present a very significant challenge. The catalysts tend to lose approximately half of their initial activity during the first 100 hours of operation at a constant PEFC voltage and even more when subjected to voltage cycling in air. Very significant improvements to PGM-free catalyst performance durability are thus required if they are to become viable for acidic PEFCs. In this presentation, we will summarize the present state of the PGM-free catalyst durability, introduce methods of assessing its assessment (including the performance metrics), and describe catalysts synthesized at Los Alamos a novel 'dual-zone' modification of the high-temperature synthesis of PGM-free catalysts. The modification has resulted in significantly enhanced durability of high-temperature catalysts, as demonstrated in H₂-air fuel cells testing both at a constant voltage and during voltage cycling. We will follow with the discussion of possible origins of the much-improved performance durability imparted by this approach.</p>	
Biographical Sketch (Approximately 200 words)	<p>Dr. Piotr Zelenay holds Ph.D. and D.Sc. degrees in Chemistry from the University of Warsaw, Poland. He has been associated with Los Alamos National Laboratory (LANL) for the past 24 years, since 2016 as a Laboratory Fellow. His research has focused on fundamental and applied aspects of polymer electrolyte fuel cells, electrochemistry, electrode kinetics, and especially in electrocatalysis, including development of catalysts for oxygen reduction reaction, methanol and dimethyl ether oxidation. Dr. Zelenay has published ca. 200 research papers, including many in renowned scientific journals such as <i>Nature</i>, <i>Science</i>, <i>Chemical Reviews</i>, <i>Accounts of Chemical Research</i>, <i>Angewandte Chemie</i>, <i>Energy & Environmental Science</i>, and <i>Advanced Materials</i>. He has co-authored over 450 presentations, including ca. 200 invited, keynote, and plenary lectures. Since joining LANL in 1997, he has successfully led numerous research projects, including large ones. Among them, he has co-directed (with his Argonne partner) and provided scientific lead for ElectroCat since its inception in 2016. Dr. Zelenay received numerous awards and recognitions, including Fellowship of the International Society of Electrochemistry (2021), DOE Hydrogen and Fuel Cells Program Fuel Cell R&D Awards (2010 & 2020); R&D 100 Award (2017); National Professorship in Chemistry by the President of Poland (2015); Los Alamos National Laboratory Fellows Prize (2015); and Fellowship of the Electrochemical Society (2014).</p>	