Impedance Response of Subcutaneous Glucose Sensors

Impedance spectroscopy is a powerful tool for investigation of electrochemical reactions and processes. This presentation provides an introduction to impedance spectroscopy and a discussion of its application to monitor the state of health of subcutaneous continuous glucose monitor sensors. Glucose sensors are a component of the artificial pancreas, used to manage type 1 diabetes. A mathematical model will be described for the impedance response of a glucose oxidase enzyme-based electrochemical biosensor. The model accounts for a glucose limiting membrane GLM, which controls the amount of glucose participating in the enzymatic reaction. The glucose oxidase was assumed to be immobilized within a thin film adjacent to the electrode. In the glucose oxidase layer, a process of enzymatic catalysis transforms the glucose into peroxide, which can be detected electrochemically.

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Mark Orazem obtained his BS and MS degrees from Kansas State University and his doctorate in 1983 from the University of California, Berkeley. In 1988 he joined the faculty of the University of Florida where, he is a Distinguished Professor of Chemical Engineering and holds the ExxonMobil Gator Chemical Engineering Alumni and a UF Research Foundation term Professorships. Prof. Orazem is a Fellow of The Electrochemical Society and served as President of the International Society of Electrochemistry. He has over 180 refereed publications and has co-authored, with Bernard Tribollet of the CNRS in Paris, a textbook entitled Electrochemical Impedance Spectroscopy. This book, published by Wiley in 2008, was translated into Chinese and published by Chemical Industry Press in 2014. The second edition is projected for publication in early 2017. Prof. Orazem’s edited book on Underground Pipeline Corrosion was published by Woodhead Publishing in 2014. In 2012, Prof. Orazem received the Henry B. Linford Award of the Electrochemical Society.