School of Engineering

Mechanical Engineering

UC MERCED

High Temperature Ceramic Fuel Cells for Zero-Carbon Power Generation

The world continues to release more than 36 Gtons of CO2 into the atmosphere annually due to our heavy reliance on fossil fuels, which provide up to 80% of the domestic energy production in many parts of the world. This poses great challenges to reduce emissions and mitigate climate change. CO2 released during energy production by air-based combustion of fossil fuels constitute a large portion of the global emissions. A sustainable energy future requires total decarbonization of the energy economy, and in particular, electric power generation. Currently however, most attention and priority have been given to the use of zero-carbon input sources such as renewables, while efforts to capture CO2 from combustion processes have been insufficient to make a significant dent in climate change.

High temperature ceramic fuel cells provide an opportunity to transition air-based combustion of fossil fuels to oxygen-based electrochemical conversion, which provides a highly concentrated product stream of CO2 ready for capture. They also offer high conversion efficiency, environmentally more friendly production of electric power, and high-quality waste heat. They also provide an alternative pathway for smooth transition into a sustainable energy economy without major disruptions in energy production by allowing continued but smart use of fossil fuels until renewables finally become the dominant source for global energy.

After framing the global energy landscape and threats to climate change, this presentation will discuss the opportunities and technical challenges of converting fossil fuels in solid oxide-base fuel cells with focus on solid fuels including coal. It will also introduce the new concept of electrochemical gasification to produce 'blue' hydrogen from fossil fuels without release of CO2 into the atmosphere. These technologies can help avoid major disruptions to energy supply and offer a smooth transition into a zero-carbon energy economy.

.

Turgut M. Gür

Department of Materials Science and Engineering

Stanford University

Turgut M. Gür is an Adjunct Professor of Materials Science and Engineering at Stanford University, where he has also provided technical and management leadership for three major multi-disciplinary research centers on advanced materials and energy conversion and storage. He is an internationally recognized leader in high temperature electrochemical energy conversion and storage technologies, materials, and processes. Currently, he is the immediate-past President of The Electrochemical Society, where he is also an inducted Fellow. He received his BS and MS degrees in Chemical Engineering from the Middle East Technical University in Ankara, Turkey, and three graduate degrees including a Ph.D. in Materials Science and Engineering from Stanford University.

Friday, November 3, 2023
10:30 am – 11:45am
COB 110

Fall 2023 Seminar Series