

## Department of Chemical Engineering Seminar Schedule



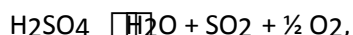
### Development of the hybrid sulfur (HyS) cycle for hydrogen production by water-splitting

Max Gorenssek

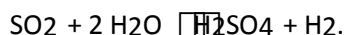
*Savannah River National Laboratory Office of Strategic Development and Innovation*

#### Abstract

HyS is a hybrid thermochemical cycle that splits water into hydrogen and oxygen using high-temperature heat and electric power. Comprising two reactions that cycle sulfur between its +4 and +6 oxidation states, HyS is not only one of the most advanced thermochemical cycles, but also the only practical two-step cycle with all fluid reactants, which greatly simplifies material handling and processing and reduces capital costs. It is a hybrid cycle because one of the two steps is electrolytic. The thermochemical step is the endothermic high-temperature catalytic vapor phase decomposition of sulfuric acid,



while the electrolytic step is the SO<sub>2</sub>-depolarized electrolysis of water,



Adding the two reactions together (recycling the sulfur species) results in the splitting of water,



HyS is being developed at SRNL for use with a concentrating solar or advanced nuclear heat source. This presentation will review the current status of the HyS process and describe ongoing as well as planned future research and development.

#### Bio

Dr. Gorenssek is a Senior Fellow Engineer in the Office of Strategic Development and Innovation at the Savannah River National Laboratory (SRNL) with over 35 years of professional experience. He has led process development and flowsheet simulation efforts for the hybrid sulfur cycle for over thirteen years, and has provided technical support for several other water-splitting technologies. His current areas of research include high-temperature water-splitting hydrogen production, process development, process intensification, and flowsheet simulation and optimization (he has an ongoing collaboration with Prof. Chen on the RAPID Modeling Center). Dr. Gorenssek is also an adjunct professor at the University of South Carolina and an Associate Editor of the International Journal of Hydrogen Energy. Before joining SRNL in 2002, he worked in the commercial chemical industry, where his experience spanned the range from bench and pilot-scale process development and catalyst testing, through steady-state and dynamic modeling and simulation of plant processes and flowsheet development, to plant and licensing technical support. He is a licensed Professional Engineer with registrations in Ohio and New Jersey. Dr. Gorenssek is a Fellow of the American Institute of Chemical Engineers (AIChE) and a Director and past Chair of the Nuclear Engineering Division of the AIChE.