

Nuclear Production of Hydrogen and Transportation Fuels

Abstract

The Idaho National Laboratory (INL) has been developing solid-oxide electrolysis cells for large-scale hydrogen production from steam using the heat and electricity of a nuclear reactor. The long-term goal of this project is to provide hydrogen for vehicles and anhydrous ammonia for fertilizers. In the shorter term, the heat and hydrogen produced by the reactor would be used for the upgrading of unconventional fossil fuels, such as oil sands, heavy crude, and oilshale to produce gasoline, diesel fuel and jet fuel. These cells have also been used in a temperature range of 800 to 900°C for the co-electrolysis of steam and carbon dioxide into synthesis gas ($\text{CO} + 2 \text{H}_2$). This gas mixture can then be used for the catalytic synthesis of lubricants and fuels.

The adequacy of worldwide uranium and thorium resources is a critical issue in the consideration of expanded uses of nuclear energy. This presentation will conclude with a discussion of recent estimates of nuclear fuel resources.

Bio

Dr. J. Stephen Herring is a Laboratory Fellow and the Deputy Director of Nuclear Science and Engineering at the Idaho National Laboratory. The NS&E Division performs reactor physics and thermal hydraulic analyses for operating and proposed reactors and conducts several small-scale experiments. He was responsible for the development of solid oxide cells for the efficient production of hydrogen and synthetic fuels using the heat and electricity from advanced nuclear reactors. He has also been active in the reactor physics analyses of nuclear fuels for the consumption of long-lived wastes and development of other advanced energy sources at the INL since 1979. He is a member of the Expert Group on Climate Change and Nuclear Energy Build Rates for the Nuclear Energy Agency in Paris and of the expert group on Hydrogen Production using Nuclear Energy of the International Atomic Energy Agency in Vienna.

Steve holds BS degrees in mechanical and electrical engineering from Iowa State University (1971), and earned a PhD in nuclear engineering from the Massachusetts Institute of Technology in 1979. He was also a Rotary Foundation Fellow at the Eidgenössische Technische Hochschule in Zürich, 1974-75, and a Visiting Scientist at the Kernforschungszentrum Karlsruhe in 1987. He received the Mishima Award for nuclear fuel development from the American Nuclear Society in 2004 and was elected a Fellow of the ANS in 2009.



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