



Contribution ID: 278

Type: Oral

Progress in nuclear clean fuel production using co-electrolysis

Solid oxide electrolyzers (SOEs) are a reliable and versatile method for producing clean fuels. SOEs can produce hydrogen from steam (electrolysis), or syngas (controllable ratios of hydrogen and carbon monoxide) from steam and carbon dioxide (co-electrolysis). Co-electrolysis provides the opportunity to produce a wide range of clean synthetic fuels, such as diesel, methane, and methanol. The energy requirements for this process can be met from nuclear electricity and heat, while carbon dioxide can be sourced from carbon emissions from hard-to-abate industries. Clean fuels produced by co-electrolysis are drop-in fuels with the ability to use existing fuels infrastructure from storage to end-use, a step that is presently a challenge for hydrogen.

Co-electrolysis provides nuclear reactor developers and operators with new economic opportunities: use excess electricity and steam for revenue generation; dedicated fuels production; and access to clean fuels markets. Although SOEs are promising, there are technological, safety, and regulatory challenges to be overcome. This paper discusses the application, status, and opportunities for clean fuel production using SOEs and nuclear energy; as well as the gaps and opportunities in the production, integration, and siting (co-locating and coupling). In addition, the regulations, and codes and standards for such production facilities will be also discussed.

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Track Classification: Topical Group A: SMR Design, Technology and Fuel Cycle: Track 5: Non-Electric Applications for SMR