2.3 Novel Composite Membranes for Hydrogen Separation in Gasification Processes in Vision 21 Energy Plants

Michael Schwartz (mschwartz@itnes.com, (303) 285-5116)
ITN Energy Systems, Inc.
8130 Shaffer Parkway
Littleton, CO 80127-4107

Abstract

ITN Energy Systems, Inc. (ITN) and its partners, the Idaho National Engineering and Environmental Laboratory, Argonne National Laboratory, Nexant Consulting, LLC and Praxair, Inc. are developing composite membranes for hydrogen separation as a key technology module within the future "Vision 21" fossil fuel plants. The ITN team is pursuing a novel approach to hydrogen separation membrane technology where fundamental engineering material development is fully integrated into module fabrication designs; combining functionally-graded materials, monolithic module concept and thermal spray manufacturing techniques.

The technology is based on the use of Ion Conducting Ceramic Membranes (ICCM) for the selective transport of hydrogen. The membranes are comprised of composites consisting of a proton conducting ceramic and a second metallic phase to promote electrical conductivity. Functional grading of the membrane components allows for the fabrication of individual membrane layers of different materials, microstructures and functions directly into a monolithic module. Plasma spray techniques, common in industrial manufacturing, are well suited for fabricating ICCM hydrogen separation modules inexpensively, yielding compact membrane modules that are amenable to large scale, continuous manufacturing techniques with low costs. The engineering and economic characteristics of the proposed ICCM approach, including system integration issues, are being assessed. This will result in an evaluation of the technical and economic feasibility of the proposed ICCM hydrogen separation approach for implementation within the "Vision 21" fossil fuel plant.

The ICCM hydrogen separation technology is targeted for use within the gasification module of the "Vision 21" fossil fuel plant. The high performance and low-cost manufacturing of the proposed technology will benefit the deployment of "Vision 21" fossil fuel plant processes by improving the energy efficiency, flexibility and environmental performance of such plants. Of particular importance is that the proposed technology also results in a stream of pure carbon dioxide. This allows for the facile sequestration or other use of this greenhouse gas. These features will benefit the U.S. in allowing for the continued use of domestic fossil fuels in a more energy efficient and environmentally acceptable manner.