

DEVELOPMENT OF ITM OXYGEN TECHNOLOGY FOR INTEGRATION IN IGCC AND OTHER ADVANCED POWER GENERATION SYSTEMS

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Description

The ITM Oxygen process uses non-porous, mixed ion and electron conducting membranes operating typically at 800-900 °C. The counter-current ion and electron paths occur through the membrane and the driving force for oxygen separation is determined by the relative oxygen partial pressure gradient across the membrane. A thin-film, multi-layer membrane structure capable of supporting the pressure load has been successfully developed. The process operating conditions constitute a medium-pressure air feed stream, typically 100-300 psig, and a low-pressure, typically sub-atmospheric, oxygen permeate stream. Since the transport mechanism is thermally activated, the separation process includes direct or indirect heating of the pressurized feed air. The energy of the hot, pressurized non-permeate stream is recovered by integrating the ITM Oxygen membrane with a gas turbine power generation system.



*Technology Development Unit (TDU)
Installed at Air Products*

Goals

The Ion Transport Membrane (ITM) Oxygen project will develop, scale-up, and demonstrate a novel air separation technology for large-scale production of oxygen and for the integration of ITM Oxygen with IGCC and other advanced power generation systems. The goal of the three-phase project is to cut the cost of oxygen production by over one-third and significantly lower the power requirement compared to conventional, competing technologies.



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A three-phase technology RD&D effort involves the design, construction, and operation of a 0.1-ton-per-day (TPD) Technology Development Unit (TDU) to establish the cost and performance targets for commercial operations. Further scale-up to a 5-TPD subscale engineering prototype facility and a 25-TPD pre-commercial-scale demonstration facility will demonstrate all necessary technical and economic requirements for commercial scale-up enabling technology commercialization in the 2006-2008 time frame.

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Benefits

ITM Oxygen production technology is a radically different approach to producing high-quality tonnage oxygen. Process engineering and economic evaluations of IGCC power plants comparing ITM Oxygen against a state-of-the-art cryogenic air separation unit found significant overall benefits for ITM Oxygen compared to the cryogenic case. Specifically, the ITM Oxygen plant is projected to decrease the installed capital cost of air separation equipment by over one-third and the installed capital cost of an IGCC facility by 7%, while improving efficiency and reducing the power requirement for air separation by approximately 35%. The efficiency increase also produces an associated reduction in carbon dioxide and sulfur emissions. These results are consistent with ITM Oxygen integration studies performed on other advanced power system designs. Core oxygen-intensive industries such as, steel, glass, non-ferrous metals, refining, chemicals, and pulp and paper, would realize significant cost, efficiency, environmental, and productivity benefits as a result of ITM Oxygen.

