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## Solid State Ionics

Volume 134, Issues 1–2, 1 October 2000, Pages 21-33

# Ion transport membrane technology for oxygen separation and syngas production

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[https://doi.org/10.1016/S0167-2738\(00\)00710-4](https://doi.org/10.1016/S0167-2738(00)00710-4)

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## Abstract

Ion transport membranes (ITMs) are made from ceramic materials that conduct oxygen ions at elevated temperatures. Successful application of ITM technology will allow significant improvement in the performance of several large-scale industrial processes. The ITM Oxygen process, in which ITMs are used to separate high-purity oxygen from air, has the potential for significant advantages when integrated with power generation cycles. The ITM Syngas process, by combining air separation and high-temperature syngas generation processes into a single compact ceramic membrane reactor, has the potential for substantially reducing the capital investment for gas-to-liquid (GTL) plants and for distributed hydrogen. The development efforts are major, long-term and high risk, and place severe demands on the performance and property requirements of the ITM materials. Air Products and Chemicals has joined with the U.S. Department of Energy, Ceramtec and other partners to develop, scale-up and commercialize these

technologies. In addition, Air Products and Ceramatec are developing the SEOS<sup>®</sup>,  
Oxygen Generator, an electrically-driven, small scale, oxygen generation and removal  
technology using ITMs, which could have a significant impact in the global market for  
distributed oxygen and inert gases. This paper describes the stages of development of  
these three related technologies, their industrial applications, and the technical hurdles  
that must be overcome before successful commercialization.



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## Keywords

Oxygen ion conductors; Oxygen generation; Air separation; Combined cycle power  
generation; Methane conversion; Synthesis gas generation; Hydrogen generation

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