Intermediate Temperature Nanostructured Ceramic Hollow Fiber Membranes for Oxygen Separation

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(I). Introduction

- **Environmental:** pure oxygen through combustion leads to carbon dioxide, which can be collected for other use or sequestration;
- **Industry:** pure oxygen increases efficiency; no need to separate nitrogen from down stream, reduce cost.
- Conventional technologies (Cryogenic distillation, pressure swing adsorption) need large capital investment and high operating cost.

(II). Ceramic membrane

- High-purity oxygen production from air;
- Economically competitive technology.

(III). Working principle

- At the feed (oxygen rich) side:
- oxygen molecule combines with electrons from the permeate (oxygen lean) side, thereby being reduced to oxygen ion;
- generated oxygen ion jumps into oxygen vacancy in dense membrane and migrates to the permeate side.
- At the permeate side (oxygen lean):
- oxygen ion is oxidized to form O₂ and release electrons;
- released electrons at the permeate side then transport back to the feed side, forming a closed-circuit loop within the membrane.

Feed side: $0.50_2 + 2e^- \rightarrow 0^{2-}$



Membrane fabrication process



(IV). Material synthesis and characterization









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