EuroSciCon

7th Edition of International Conference and Exhibition on

Separation Techniques

July 05-07, 2018
Berlin, Germany

Arch Chem Res 2018, Volume 2
DOI: 10.21767/2572-4657-C3-009

HYDROGEN SEPARATION BY TITANIUM NANOCRYSTALLINE MEMBRANES WITH INTERFACIAL HYDRIDE ION CONDUCTIVITY

Yoshitaka Aoki
Hokkaido University Japan

Indeed, the increasing demand for pure hydrogen as a clean and efficient energy source has drawn much academic and industrial interest to the development of non-Pd-based alternatives. Since hydrogen dissolved in the metal matrix aids its deformation, metals exhibiting high hydrogen solubility are subject to increased embrittlement. Thus, materials scientists are faced with the challenge of designing hydrogen separation membranes that do not rely on hydrogen solubility in a metal matrix. Mixed proton-electron conductors (MPECs) are promising alternatives to dense separation membranes, featuring ambipolar diffusion of H+ and e−. Although perovskite-type BaM1−xM'xO3− (M = Ce, Zr; M' = Y, Yb, etc.) proton-conducting ceramics have been extensively studied as potential MPECs, they require operation at elevated temperatures (T > 600 C) due to high migration activation energies (50-60 kJ mol−1) attributed to trapping by negatively charged aliovalent dopants or defect-induced structural distortions. Herein, we report pronounced hydride ion-electron conductivity of nanocrystalline titanium nitride (TiNx),1,2 attributed to interfacially controlled diffusion aided by hydridic Ti−H terminal groups on the hydrogenated grain surface. Such materials allow much faster hydrogen permeation than that observed for Pd metal at close-to-ambient temperatures.

y-aoki@eng.hokudai.ac.jp