

## Microstructure of Hydrogen Permeation Barrier Coatings

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**Abstract :** Ceramics coatings consisting of fine crystal grains, with diameters of about 100 nm or less, provided superior hydrogen-permeation barriers. Applying TiN, TiC or Al<sub>2</sub>O<sub>3</sub> coatings on a stainless steel substrate reduced the hydrogen permeation by a factor of about 100 to 5,000 compared with uncoated substrates. Effect of the microstructure of coatings on hydrogen-permeation behavior is studied. The test specimens coated with coatings, with columnar crystals grown vertically on the substrate, tended to exhibit higher hydrogen permeability. The grain boundaries of the coatings became trap sites for hydrogen, and microcrystalline structures with many grain boundaries are expected to provide effective hydrogen-barrier performance.

**Keywords :** hydrogen permeation, tin coating, microstructure, crystal grain, stainless steel

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