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Hydrogen Permeation Behavior of BN Coatings by Magnetically-Enhanced Plasma Ion Plating

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The effects of chemical composition, phase composition, and microstructure of boron nitride coatings on hydrogen permeation behavior were investigated. The coatings were deposited on Type 316L stainless steels by magnetically enhanced plasma ion plating. This technique employs a confined plasma source consisting of two magnetic poles in a special arrangement and a substrate-current control unit for improving the bulk and interface properties of coatings.
Hydrogen-permeation tests were performed on the coated stainless steel samples. These tests were based on the differential-pressure methods described in ISO15105-1:2007.
The permeation of hydrogen through solid materials involves a series of steps including adsorption, dissociation, diffusion, and recombination coupled with desorption. In this study, a diffusion-limited permeation regime was confirmed on the coatied samples at 573-773 K.
Fine-grained c-BN (cubic boron nitride) coating was effective to reduce the rate of hydrogen permeation. These BN coatings can be used for high-temperature and wear-resistant applications as hydrogen permeation barriers. They might be useful for sterling engines, tritium containment, or components of hydrogen fuel cells.

Keywords
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