

## Effect of Hydrogen Content and Structure in Diamond-Like Carbon Coatings on Hydrogen Permeation Properties

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**Abstract :** The hydrogen barrier properties of the coatings of diamond-like carbon (DLC) were evaluated. Using plasma chemical vapor deposition and sputtering, DLC coatings were deposited on Type 316L stainless steels. The hydrogen permeation rate was reduced to 1/1000 or lower by the DLC coatings. The DLC coatings with high hydrogen content had high hydrogen barrier function. For hydrogen diffusion in coatings, the movement of atoms through hydrogen trap sites such as pores in coatings, and crystal defects such as dislocations, is important. The DLC coatings are amorphous, and there are both sp<sup>3</sup> and sp<sup>2</sup> bonds, and excess hydrogen could be found in the interstitial space and the hydrogen trap sites. In the DLC coatings with high hydrogen content, these hydrogen trap sites are likely already filled with hydrogen atoms, and the movement of new hydrogen atoms could be limited.

**Keywords :** hydrogen permeation, stainless steels, diamond-like carbon, hydrogen trap sites

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