Development of Metal containing DLC film for High Performance of Bipolar Plates

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Recently, the issue of the various researches is to develop the metallic bipolar plate for PEMFC with low cost and high functionality. These studies were performed on a metallic plate using stainless steel with excellent corrosion resistance, mechanical property and ease of manufacture. However, it is dissolved under fuel cell operating conditions. Dissolved ions contaminate a membrane electrode assembly and metal oxide on the surface of stainless steel increases the contact resistance in the fuel cell. To solve this problem, the surface treatment is needed. Therefore In this study, We have deposited titanium containing diamond like carbon film in order to avoid these problems and to satisfy the functional characteristics. Deposition of Ti containing DLC films has been investigated in a RF plasma enhanced CVD process using metal-organic source on the SUS316L. The film was found to be composed of amorphous titanium oxide, nano crystalline titanium carbide and titanium nitride embedded in an amorphous hydrogenated DLC matrix. Each phase ratio in the DLC matrix was dependent on the process parameter such as gas flow ratios, process pressure, source power and temperature. The effect of deposition parameters on the properties of the Ti-DLC films were characterized with respect to their morphology, microstructure, chemical composition and mechanical properties by scanning electron microscopy (SEM), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS) and nano-indentation studies, respectively. Finally high conductivity and corrosion resistance of the resulting coating is a reasonably possible candidate for bipolar plate for PEMFC.

Keywords
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