IMPROVEMENT of a-C:H FILM ADHESION for MEDICAL INSTRUMENTS USING PLASMA TECHNIQUE*

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Amorphous hydrogenated carbon (a-C:H) films provide low friction, extreme hardness, chemically inertness, and good biocompatibility. a-C:H films have been expected a surface modification coating to medical appliances[1]. However, poor adhesion of a-C:H film onto medical instruments which is metallic material limits their application. In order to improve the adhesion, the most typical method is deposition of interlayers between the metallic material surface and a-C:H film. Therefore, we have focused on plasma pre-treatment as a simplification plasma technique where it is possible to deposit strong adhesion a-C:H film to metallic materials which are used in medical instruments like clamps or surgeon's knife etc.

In this study, a-C:H film was deposited on SUS 304 material without interlayer by only r.f. plasma CVD technique. Before the film deposition, the surface of the metallic materials was modified with H_2 plasma and N_2 plasma as a pre-treatment to improve the adhesive strength of the film. The pre-treatment was carried out under the following conditions: H_2 and N_2 gas pressure at 10 Pa with a treatment time of two and four minutes, respectively. After the pre-treatment, the r.f. plasma decomposed CH_4 gas (10 Pa), and deposited a-C:H film with a deposition time of 10 minutes.

To investigate the effect of the plasma pre-treatments, chemical conditions of the interface were analyzed by XPS. It was observed that the pre-treatment removed hydroxide, and the SUS substrate surface became N-rich. Moreover, the a-C:H film structures and adhesion strength were investigated by Raman spectroscopy, XPS and scratch tests. From these results, the a-C:H film was completely deposited with strong adhesion without interlayer by using the r.f. plasma CVD technique. This technique has the effect of a-C:H films adhesion onto metallic materials which are used in medical instruments the same as using an interlayer.

1. WJ. Ma, AJ. Ruys, RS. Mason, PJ. Martin, A. Bendavid, Z. Liu, M. Ionescu, H. Zreiqat, Biomaterials, 28 (2007) 1620

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