Diamond coating on the tungsten rod by DC plasma CVD using organic-solution as the cathode

KUROKAWA Takahiro, MATSUSHIMA Yuta, SUZUKI Takeyuki
Tokyo University of Agriculture and Technology (TUAT)
2-24-16 Nakamachi, Koganei-shi, Tokyo 184-0012

1. Introduction

Diamond possesses an excellent abrasion tolerance and a low frictional coefficient, and therefore it is considered as the most suitable material for slide component for shaft carrier. We developed a plasma production method above the liquid surface which uses a liquid cathode and deposits a diamond film on the tungsten substrate. This method is a kind of the DC plasma CVD and it shows a high-speed diamond coating of about 10 μm/h. One of the important advantages of this method is that the deposit is free from any metal contamination by metal cathode. A series of researches were made to prepare the homogeneous coatings on the rod.

2. Experiments

A tungsten rod with the dimensions of 5mmφ and 31mm long was used as a substrate. No pretreatment was carried out except on the rod the ultrasonic washing in the mixture of the ethanol and distilled water. For cathode liquid, the mixed solution of ethylene glycol, and water was used. A small amont of the hydrochloric acid was added for the adjustment of the electrical conductivity. Deposition was carried out and the following conditions, around 200 Torr and 800-1000 Cº. The deposited films were characterized by the Raman spectroscopy and the Scanning Electron Microscopy (SEM).

3. Results and discussion

Fig. 1 and Fig. 2 shows the Raman shift and the SEM image of the deposits, respectively. The SEM image shows the well faceted diamond particles of 1-3 μm diameter. The deposition time was 1.5 h. Influence of the rod rotation on the formation of the deposits morphology was also examined. Father details will be presented.

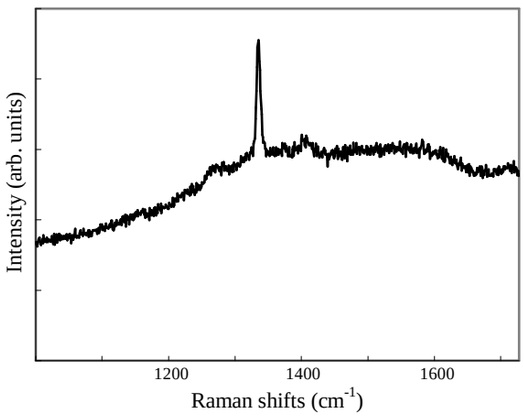

Fig. 1. Raman spectra of deposits.

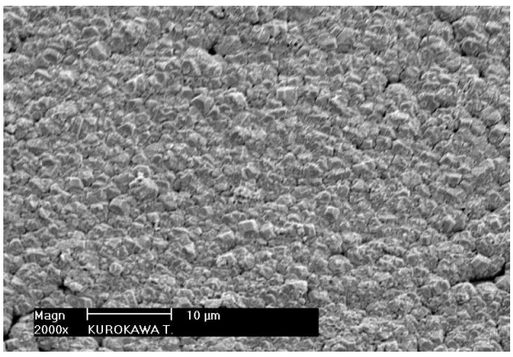

Fig. 2. SEM image of the deposited diamond on the W substrate.