

The influence that helium-hydrogen mixture atmospheric pressure plasma gives an aluminum film

ヘリウム-水素混合大気圧プラズマがアルミニウム薄膜に与える影響

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The hydrogen behavior of the interaction between aluminum films and the He/H₂ mixing plasma under atmospheric pressure is investigated. The aluminum films deposited on tungsten substrates up to the temperature of 150 °C are exposed by He/H₂ plasma using 100 MHz RF power supply. The substrates exposed by the plasma are heated in a thermal desorption device. In this presentation, the amount of the hydrogen retention into the aluminum film will be discussed.

1. Introduction

Recently, the characteristic of aluminum as a hydrogen storage alloy is attracting the attention for the application of a fuel cell. Unfortunately, aluminum easily forms oxide layers on the surface so that it is hard for hydrogen molecules to diffuse into the aluminum bulk.

Atmospheric pressure plasma has good advantage for high reaction rate and low energy as chemical vapor deposition. If the aluminum surface will be exposed by the helium and hydrogen mixture plasma under high pressure condition, the oxide layers on the aluminum surface is possible to be efficiently removed.

In the study, hydrogen retention of the aluminum films is investigated using thermal desorption method in order to recognize the fundamental behavior of the interaction between the aluminum film and the He/H₂ plasma under atmospheric pressure plasma,

2. Experimental

Figure 1 shows a schematic of a experimental apparatus. A sample holder and a rf electrode are equipped in a main vessel chamber. The sample temperature was monitored using K-type thermocouple which was bonded by the graphite bond on the back side of the sample. After high vacuum condition was achieved in order to reduce the influence of the oxide contamination, atmospheric plasma using 100 MHz RF power supply was generated at 0.9×10^5 Pa under the mixture of He and H₂ gases at the flow rate of 20 slm and 50 sccm, respectively.

The tungsten was used as a substrate. Thin aluminum films were deposited on the tungsten

substrates by magnetron sputtering method. In this method, Ar gas was strictly controlled at 6 sccm by a mass flow meter and a discharge power of 200 W was applied in order to generate Ar plasma at total pressure of 4 Pa. The aluminum films deposited on the tungsten substrates were exposed by He and H₂ mixture plasma under atmospheric condition. After the exposure, all samples were heated up to 527 K with a heating rate 0.05 K/s in order to estimate the hydrogen retention. In this presentation, the amount of the hydrogen retention into the aluminum film will be discussed.

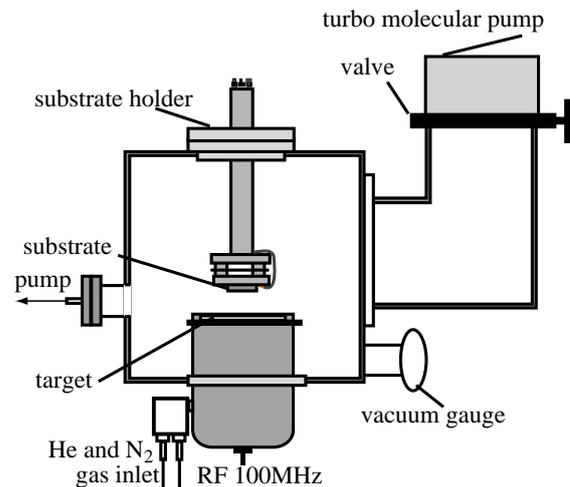


Fig.1. schematic of experimental apparatus