

PO4010

**Titanium deposition on polymer substrate by high-power pulsed sputtering
Penning discharge in Ar/N₂ mixture gas ambient**Kingo Azuma¹, Ryo Nagai¹, Yoshihiro Oka¹, Shin-ichi Honda¹, Takashi Kimura²,
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High power pulsed sputtering (HPPS) is the method of obtaining metallic plasma by applying negative high voltage pulses with peak power higher enough than the electric power used by DC sputtering to a cathode. We cause HPPS-discharge using a Penning discharge type target cathode. HPPS Penning discharge is featured that the plasma is generated at a space consisting of a pair of cathodes as sputtering target (W24×H20×t5) in parallel each other. Distance between targets is 10 mm. The magnetic field is provided by setting a set of permanent magnets (O14×17, NdFeB) behind the targets. Energetic argon ions accelerated by a voltage difference between the cathode and the plasma are bombarded to the sputter target, and emit the metallic target atoms and secondary electrons. Secondary electrons are confined between the two targets by magnetic field and electrical potential wall, ionize the target atoms, and improve the metallic plasma density. Therefore the metallic plasma flows out to the deposition area. When thin film is deposited on the substrate in this plasma, a substrate is not heated so much because the sputtering targets which become high temperature are perpendicularly to the substrate. We generated titanium plasma under argon/nitrogen mixture gases, and tried deposition of the titanium thin film on a polymer substrate. The voltage pulse-train (amplitude of -800 V and pulse duration of 50 μs) was applied to the titanium sputter target at the repetition rate of 500 Hz under the argon gas of 10 sccm, nitrogen gas of 0.26 sccm, and the gas pressure of 0.5 Pa. The titanium thin films were deposited on the glass, polypropylene (PP) and polypropylene (PS) substrates located at 30 mm from the plasma source. The XRD pattern of any substrate showed that deposited thin film was titanium nitride. The color of thin film on a glass was clear gold. On the other hand, it was dull gold on PS and was dark gold on PP.

Keywords

Pulsed sputtering

Penning discharge

titanium plasma

Reactive deposition

Polymer