Preliminary results on adhesion improvement using Ion Beam Sputtering Deposition

Kim Yong Gi, Kim Bom Sok, Lee Jae Sang
KAERI, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Korea, yonggi@kaeri.re.kr

1. Introduction

Plasma-based ion implantation including plasma source ion implantation [1,2] and plasma immersion ion implantation [3,4] have emerged as a powerful surface engineering technology in recent years. Ion beam sputtering is an attractive technology for the deposition of thin film coatings onto a broad variety of polymer substrates. Besides the inorganic substrates for high-precision other applications also polymer substrates for consumer other components are of growing interest. Sputtering is an established technique for depositing films with smooth surfaces and interfaces and good thick control. Ejection of particles from a condensed matter due to impingement of high energy particles, termed as sputtering was observed as early as in1852 [5], however, it is only recently that the complex process of sputtering system.

2. Methods and Results

Ion beam sputtering deposition apparatus was used in this study. Both ion sources were bucket-type.

Fig1. Ion beam sputter deposition equipment.

Fig1. Show the Ion beam sputter deposition equipment. PVD coating method is difficult of alloy coating and adhesion. however, it is able to high current ion beam sputtering deposition method. PVD coating method has the adhesion of 20-30N. High current ion beam sputtering deposition method will be enhance the adhesion. Fig2. Show the typical values indicative of average industry standards.

The process condition be used work pressure 1.2E-4 torr, voltage 20KeV, current 100mA, and Ar gas 99.999% purity, respectively.

	Electron beam evaporation	Magnetron Sputtering	Ion Beam Sputtering
Deposition Rate	>10 Å/sec	~10 Å/sec	~3 Å/sec
Thermal Conductivity	Low	High	High
Temperature Range	200 - 300°C	20 - 100°C	20 - 150°C
Surface Micro-Roughness	+10Å RMS	<5Å RMS	<1Å RMS
Density / Porosity	Porous	Near bulk	Near bulk
Adhesion / Durability	Low	Very good	Excellent
Humidity Sensitivity	Yes	No	No
Aging Effects	Yes	No	No

Fig2. These values are typical values indicative of average industry standards.[6]

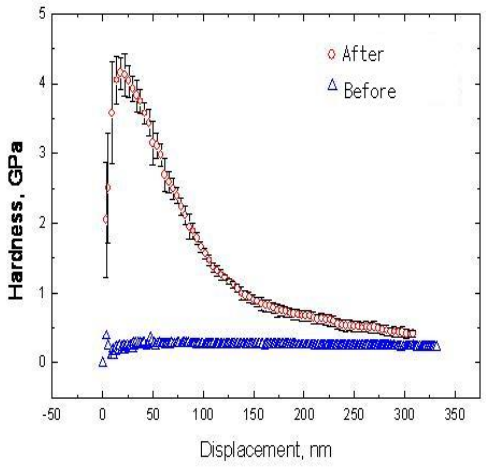

Fig3. Nanoindentation property Before ion beam irradiation and After ion beam irradiation.

Square specimens (100mm x 100mm) were cut from a 0.3mm thick sheet of SUS coating. The specimens were cleaned with alcohol before ion beam irradiation.

The cross-cut test is a simple and easily practicable method for evaluating the adhesion of single- or multi-coat systems.

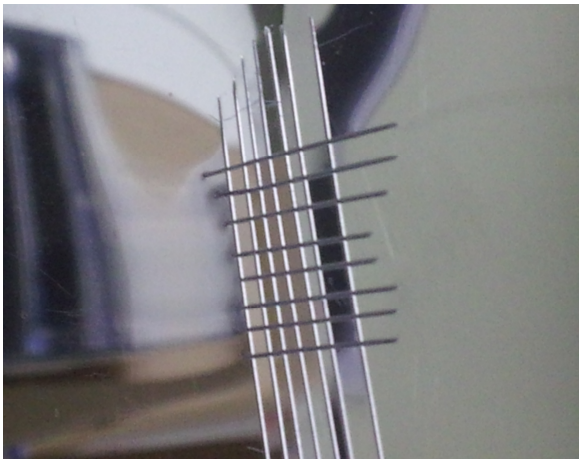

Fig4. Cross cut test pattern image of the SUS coating film on polymer (PET) substrate.

Make a lattice pattern in the film with the appropriate tool, cutting to the substrate. Brush in diagonal direction 5 times each, using a brush pen or tape over the cut and remove with tape. Examine the grid area using an illuminated magnifier

The coating adhesion of the thin films was tested by the tape-test at a crosshatch-cut [7]. The adhesion force of the films was measured with a cross cut tape test. The adhesive force of SUS coating thin films onto polymer substrates was estimated by the cross-cut test in which an adhesive tape is used to peel off a SUS coating thin film cross-cut the polymer(PET) substrate. The results of the cross cut test to determine the adhesive character of the polymer (PET) substrates are given in Fig 4. We found that SUS coating films produced adhered to the polymer substrates very strongly.

3. Conclusions

Coating adhesion and environmental stability of the ion beam sputtering deposition coatings performed very well.

High-energy high-current ion beam thin film synthesis of adhesion problems can be solved by using.

Enhancement of adhesion in thin film synthesis, using high energy and high current ion beam, of mobile phones, car parts and other possible applications in the related industry

Alternative technology of wet chrome plating, considering environment and unit cost, for car parts and esthetic improvement on surface of domestic appliances.

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