Measurement of ion induced secondary electron emission coefficient(γ) and work function of vacuum annealed MgO protective layer in AC PDP

J. Y. Lim, H. S. Jeong, W. B. Park, J. S. Oh, J. M. Jeong, and E. H. Choi

Charged Particle Beam and Plasma Laboratory / PDP Research Center, Department of Electrophysics, Kwangwoon University, Seoul, Korea 139-701.

Phone : +82-2-940-5236 , E-mail : mir3292@empal.com

ABSTRACT

The secondary electron emission coefficient(•) of vacuum annealed MgO films has been investigated by • -focused ion beam(• -FIB) system. The vacuum annealed MgO films have been found to have higher • values than those for as-deposited MgO films for Ne+ ion . Also it is found that the • for air-hold of vacuum annealed MgO layers for 24-hours is similar to that for vacuum annealed MgO films without any air-hold.

1. INTRODUCTION

The characteristics of MgO film are very important for the development of recent AC-type plasma display panel(AC-PDP)[1,2]. An ion-induced secondary electron emission coefficientγ is one of the MgO film characteristics which is correlated to the ignition voltage of PDPs[3]. MgO films as the protective layer in AC-PDPs is generally annealed under vacuum environment in order to eliminate absorbed materials onto the MgO layer. Vacuum annealing is one of the most important processes for forming long-lived panel.[4] It is of great importance to investigate the influence of vacuum annealing on the ion-induced secondary elctron emission coefficient γ from a MgO protective layer. In this research, γ of the vacuum annealed MgO films has been investigated by γ-focused ion beam (γ-FIB) system. Also, the characteristics of γ for as-deposited and vacuum annealed MgO films have been investigated and compared with each other throughout this research.

2. Experimental Configuration

The MgO protective layer is deposited on the dielectric layer by electron beam evaporation at deposition rates of approximately 5~10Å/s in a vacuum of about 1.1×10^{-6} Torr. The thickness of MgO layer is about 5000Å. The deposited MgO films have been vacuum annealed at 300℃ for 15 minutes. Also some of the as-deposited MgO films has been air-hold by 24-hours in this experiment. The secondary electron emission coefficient characteristics for these two MgO films have been measured by γ-FIB system and compared with each other throughout the experiment. Figure 1

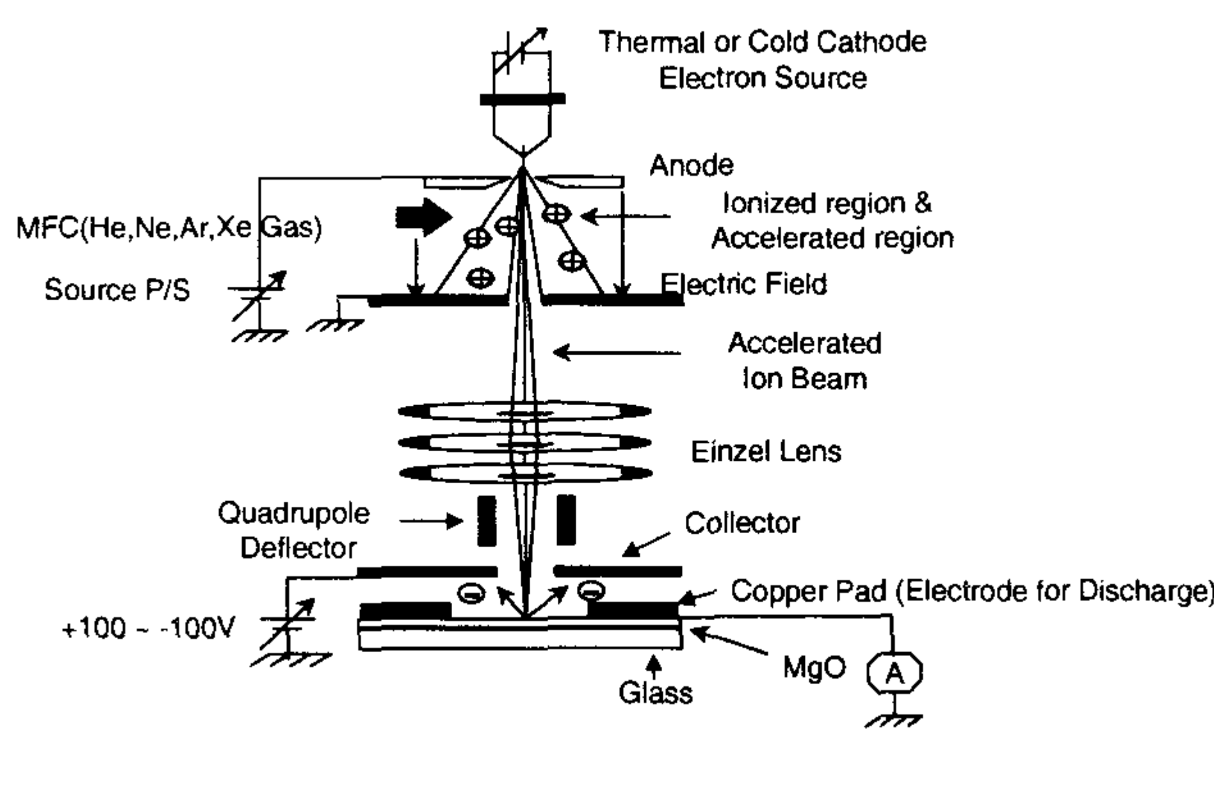

Figure 1 The schematic γ-FIB

shows the schematic γ-FIB system for measurement of secondary electron emission characteristics from MgO single crystal. The system is broken down into five basic components : the diode consisting of thermonic electron source and anode, electron-impact ion formation and its acceleration region, electrostatic single Einzel lens for ion beam focusing, quadrupole deflector, and substrate for γ measurement of MgO single crystal, respectively. The background vacuum pressure of γ-FIB is maintained at 1.6×10^{-5}Torr, where it is kept by up 7×10^{-5}Torr during ion beam formation mainly at the nearby region of 2mm-diam. anode hole by gas feeding. The ions are produced by impact collisions of thermal electrons emitted from filament to the He, Ne, Ar, N2, and Xe. The kinetic energy of ions is depended on the ion accelerating voltage applied to the anode. The anode positive biased and can be +50 up to +500V for the ion acceleration, and these ions are passed through the 0.5mm-diam. beam defining aperture along downstream of the system. The ion beam is the focused by single electrostatic Einzel lens and scanned by the quadrupole deflector onto the MgO surface with fixed focused beam diameter of 80μm throughout this experiment, which can be achieved by adjusting the filament heating current under the given ion acceleration energy.

3. Experimental Results and Discussions

Figure 2 shows γ for as-deposited and vacuum annealed MgO films for Ne+ and Xe+ ions, respectively, versus ion accelerating voltages 50V up to 200V. The vacuum annealed MgO films have been found to have the highest γ from 0.05 up to 0.12 for operating Ne+, while from 0.03 up to 0.05 for Xe+ ions, respectively, ranging from 50eV to

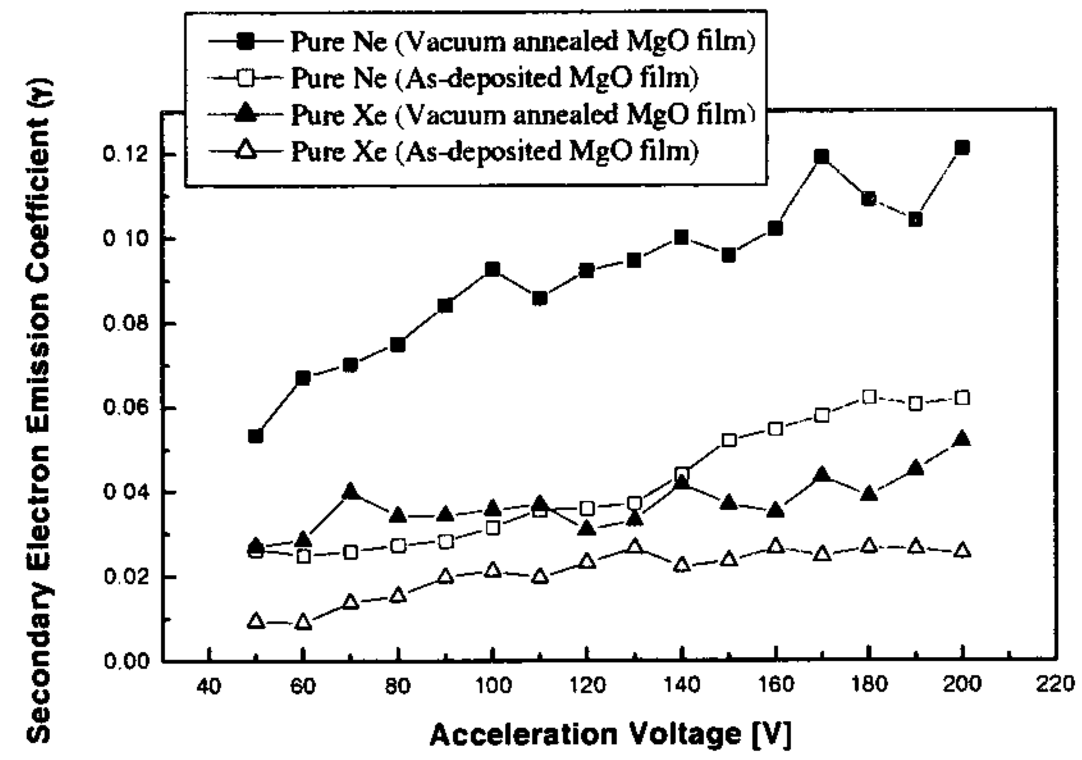

Fig.2 γ for as-deposited and vacuum annealed MgO films for Ne+ and Xe+ ions

200eV throughout this experiment. Figure 3 shows γ for air-hold by 24-hours of as-deposited and vacuum annealed MgO films according to pure Ne+ and Xe+ ions, respectively, versus ion accelerating voltages 50V up to 200V. It is noted that the γ's for air-hold of vacuum annealed MgO films are similar to those in Fig.2 for vacuum annealed MgO films without any air-hold. It is also noted that the γ of for air-hold of as-deposited MgO films are lower than those in Fig.2 for as-deposited one. Exactly, γ of as-deposited MgO protective layer has been decreased rapidly by influence of air-hold because of absorbed of OH groups from MgO

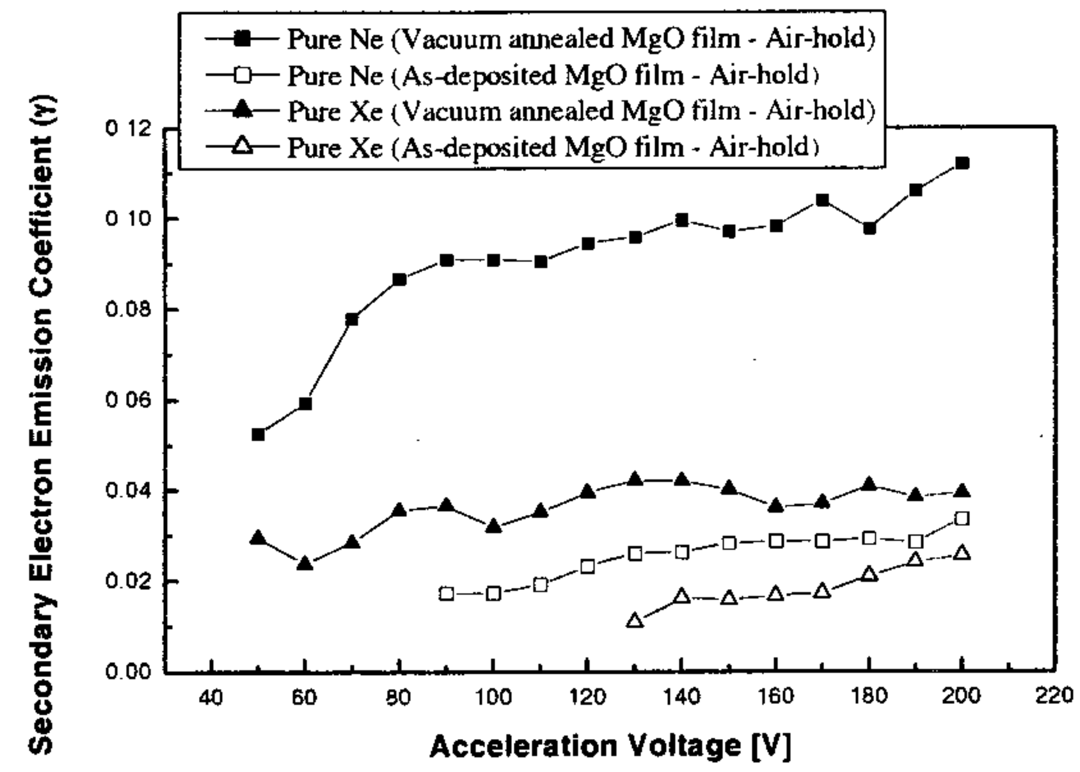

Fig.3 γ for air-hold by 24-hours of as-deposited and vacuum annealed MgO films according to pure Ne+ and Xe+ ions

surface. And it is noted that the γ for vacuum annealed MgO protective layer has been shown to be less influence of air-hold than that of as-deposited MgO protective layer

4. Conclusion

The γ of vacuum annealed MgO films has been investigated by γ-FIB system. The vacuum annealed MgO films have been found to have.06 for as-deposited MgO films for operating Ne+ ion energies ranged from 50eV to 200eV. The vacuum annealed MgO films or air-hold of it have been found to have the highest γ, while to have the lowest one for the air-hold higher γ values from 0.05 to 0.12 than those from 0.03 to 0 of as-deposited MgO films. Based on these facts, it can be concluded that vacuum annealed MgO protective layer plays an important role in lowering the firing voltage in AC-PDP compared with the as-deposited or air-hold of as-deposited MgO protective layer.

5. References

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