

기판 인가 전압이 MSNIS 방식으로 증착된 ITO 박막 물성에 미치는 영향  
Influence of positive bias voltage on the properties of ITO films by magnetron sputter  
type negative metal ion source

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## 1. 서론

Transparent conducting indium tin oxide (ITO) thin films on polymer substrates have attracted much attention in flexible electro-optical devices and unbreakable heat reflecting mirrors because they have many merits, such as light weight, small volume, and flexibility compared with ITO films deposited on glass substrate<sup>1,2)</sup>. However, in order to produce flexible optoelectronic devices, all deposition processes should be performed at a low substrate temperature due to the high thermal expansion and low thermal resistance of the polymer substrates<sup>3)</sup>. In this study, ITO films were prepared onto polycarbonate (PC) substrate without intentional substrate heating by magnetron sputter type negative metal ion source (MSNIS) which needs cesium (Cs) vapor as a surface negative ionization agent. The structural and optoelectrical properties of the films were considered by the four-point probe, UV-visible spectrophotometer, and atomic force microscopy (AFM), respectively.

## 2. 본론

In a magnetron sputter type negative metal ion deposition, the influence of positive bias voltage ( $V_b$ ) on the surface morphology, electrical resistivity, optical transmittance, and microhardness of ITO film has been investigated. In this study, the  $V_b$  increased from 0 to 250 V to attract secondary negative metal ions, which were produced by surface negative ionization with intense Cs ion bombardments. By adjusting  $V_b$  at 100 V, ITO films on polycarbonate substrate with resistivity as low as  $6.1 \times 10^{-4} \Omega \text{ cm}$  and transmittance over 90% at 550 nm have been obtained. AFM measurement also shows that surface roughness varied significantly with  $V_b$ . However, too intense ion bombardment originated by high  $V_b$  ( $> 100\text{V}$ ) condition increased surface roughness and as a result deteriorated the electrical and optical property of ITO films.

### 3. 결과

ITO thin films have been deposited onto polycarbonate substrate by magnetron sputter type negative metal ion beam deposition. The influence of positive substrate bias voltage on the structural, optical, and electrical property of ITO films was studied.

AFM image shows that the polycrystalline ITO films with the minimum roughness of 1.2 nm could be prepared at the  $V_b = 100$  V. In addition, ITO film prepared at  $V_b = 100$  V also shows higher optical transmittance (92% at 550 nm) and lower resistivity ( $6.1 \times 10^{-4} \Omega \text{ cm}$ ) than that of the films prepared with another  $V_b$  conditions. The microhardness of the film also varied with  $V_b$ . From the results, it can be concluded that the most effective substrate bias voltage in MSNIS process for the ITO deposition is +100 V, where the  $F_H$  is the highest.

### 참고문헌

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