

## TiN 박막의 건식 식각 특성 Dry Etching Characteristic of TiN Thin Films using Inductively Coupled Plasma

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**Abstract :** TiN is one of the mostly used barrier materials in copper metallization because of low friction coefficient and superior electrical properties. We need to investigate for the etching characteristic of TiN. In this study, we investigated about etching characteristic of TiN using BCl<sub>3</sub>/Ar inductively coupled plasma system. The etch rate was measured by a depth profiler. The chemical etching reactions of the TiN surface was investigated X-ray photoelectron spectroscopy.

**Key Words :** TiN, etch, XPS, BCl<sub>3</sub>

### 1. 서 론

Copper is an attractive material as a new interconnection metallization in ultra large scale integrated (ULSI) circuit. Copper have low electrical resistivity and superior resistance to electromigration. However copper has many drawbacks such as the high diffusivity in silicon and dielectric materials, difficulty of anisotropic etching, poor corrosion resistance and poor adhesion to most dielectric materials [1-2]. Therefore, it needs a diffusion barrier such as titanium nitride. TiN is one of the mostly used barrier materials in copper metallization because of low friction coefficient and superior electrical properties [3]. The bottom TiN layers prevent electromigration and metal-to-Si contact. The top TiN layers reduce standing wave and notching effects on the photoresist pattern due to the reflection of the exposure light in photolithography. And the top TiN is also used for hardmask [5-6]. Etching performance of these metal stack structures depend on top TiN layer. There are several researches of the etching characteristic of TiN. However we need more studies for the etching characteristics of TiN because of its important role in metal stack structure. In this study, we focus on the investigation about etching characteristic of TiN films using BCl<sub>3</sub>/Ar/N<sub>2</sub> inductively coupled plasma system (ICP). The chemical reactions on the surface of TiN thin films are investigated in X-ray photoelectron spectroscopy (XPS).

### 2. 결과 및 토의

Etch characteristics of TiN film have been studied. As a functions of BCl<sub>3</sub>/Ar gas mixing ratio, RF power, DC-bias voltage and process pressure. TiN is little etched as function of Ar plasma, the etch rate is increased by the addition of BCl<sub>3</sub> and N<sub>2</sub>. However the etch rate is decreased proportionally by increasing a mounts of BCl<sub>3</sub> and N<sub>2</sub>. The highest etch rate is shown as functions of BCl<sub>3</sub> (5sccm)/Ar (15sccm)/N<sub>2</sub> (4sccm) gas mixing ratio. The higher RF power and the higher DC bias, the etch rate is higher. The lower pressure, the etch rate is higher. The chemical etching reactions of TiN surface may be explained by XPS analysis. The Ti peak is changed during the etch process. TiO<sub>2</sub> peak is smaller during the process compared with TiN peak.

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