BCl_3/Ar 플라즈마에서 Cl_2 첨가에 따른 TiN 박막의 식각 특성

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Etch characteristics of TiN thin film adding Cl_2 in BCl_3/Ar Plasma.

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Abstract : Dimension of a transistor has rapidly shrunk to increase the speed of device and to reduce the power consumption. However, it is accompanied with several problems like direct tunneling through the gate dioxide layer and low conductivity characteristic of poly-Si gate in nano-region. To cover these faults, study of new materials is urgently needed. Recently, high dielectric materials like Al_2O_3, ZrO_2, and HfO_2 are being studied for equivalent oxide thickness (EOT). However, poly-Si gate is not compatible with high-k materials for gate-insulator. Poly Si gate with high-k material has some problems such as gate depletion and dopant penetration problems. Therefore, new gate structure or materials that are compatible with high-k materials are also needed. TiN for metal/high-k gate stack is conductive enough to allow a good electrical connection and compatible with high-k materials. According to this trend, the study on dry etching of TiN for metal/high-k gate stack is needed.

In this study, the investigations of the TiN etching characteristics were carried out using the inductively coupled BCl_3-based plasma system and adding Cl_2 gas. Dry etching of the TiN was studied by varying the etching parameters including BCl_3/Ar gas mixing ratio, RF power, DC-bias voltage to substrate, and Cl_2 gas addition. The plasmas were characterized by optical emission spectroscopy analysis. Scanning electron microscopy was used to investigate the etching profile.

Key Words : Etching, TiN, Plasma, ICP, BCl_3/Ar