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Analysis of the surface reactions of ArF photoresist during fluorocarbon plasma etching by XPS TAKUYA TAKEUCHI, MAKOTO SEKINE, HIROTAKA TOYODA, KEIGO TAKEDA, MASARU HORI, Nagoya University, SONG-YUN KANG, IKUO SAWADA, Tokyo Electron Ltd. — High-aspect ratio pattern etching processes with nano-scale accuracy is desired in such as a contract hole etching for the silicon dioxide that is used as a dielectric passivation layer over MOSFETs. However, photoresist used in the advanced ArF lithography is not tolerant enough for plasma etching processes, and it often causes deformations in the etched feature with bowing, distortion, twisting and so on. It is important to investigate the reaction of photoresist with fluorocarbon to overcome these problems and realize sophisticated etch processes. In this research, the modified layer of the photoresist by bombardment of CF_x^+ ions was analyzed. The ions, such as CF^+, CF_2^+, CF_3^+, and F^+, were produced from CF_4 gas by electron impact, and selected by quadrupole mass filter. The CF_x^+ ions were bombarded to ArF photoresist as ion beam with an accelerated energy from 100 to 400 eV. The equipment system is evacuated by four turbo molecular pumps. Ultimate pressure of the equipment is lower than 10^{-9} Torr. The beam equipment and XPS analysis chamber are connected in vacuum, so we can use XPS analysis without atmospheric influence after the ion etch process. In this study, we investigated the modified layer of the photoresist by *in-situ* XPS.

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