

Abstract Submitted
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Roughness formation on photoresist during etching examined by HBr plasma-beam MAKOTO SEKINE, YAN ZHANG, KENJI ISHIKAWA, KEIGO TAKEDA, HIROKI KONDO, MASARU HORI, Nagoya University, PLASMA NANOTECHNOLOGY TEAM — For highly precise patterning in device fabrication, it is required to suppress roughness formations on photoresist (PR) polymers during plasma etching. HBr plasma treatment called “plasma cure” was proposed to reduce the roughness [1]. By using a beam irradiation, we reported the PR roughness formation in fluorocarbon plasma [2], and the effect of HBr cure. We report the roughness formation mechanism by surface analyses and power spectral density (PSD) of the roughness. Average slope and roll-off frequency of PSD are characterized by frequency components, the high-frequency roughness. We treated the data for six samples: a) pristine, b) after Ar plasma irradiation, c) after Ar plasma followed by HBr cure, d) after HBr cure, e) after HBr followed by Ar plasma beam, and f) after HBr followed by H₂ and Ar plasma beam irradiations. The PSD slopes were changed by each process. Based on the results, we speculated that the Ar-plasma beam formed a crust layer on the PR surface with unrelieved stress and HBr cure may soften the bulk PR to relieve the stress and cause agglomeration of polymers at the size over 10 nm.

[1] A. Ando et al., Thin Solid Films 515, 4928 (2007).

[2] T. Takeuchi et al., J. Phys. D: Appl. Phys. 46, 102001 (2013).

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