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Incident angle dependence of metal etching using a gas cluster ion beam in acetic acid atmosphere

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Abstract

The dependence of Ru, CoFe, and SiO_2 etching with O_2-GCIB in an acetic acid atmosphere on the angle of incidence was studied. In the case where an acceleration voltage (Va) of 20 kV was used, the depth to which Ru was etched using O_2-GCIB with acetic acid decreased significantly with increasing incident angle. However, the etch depth produced with an acceleration voltage of 5 kV, with O_2-GCIB in acetic acid, did not show a rapid decrease at high incident angles. The etch selectivities of Ru and CoFe to SiO_2 at an incident angle of 70^o and a Va of 5 kV with acetic acid were 7.6 and 10.4, respectively. This indicates that reactive etching occurred with these metals. Based on XPS and cross-sectional TEM, there was no observable damage to CoFe after O_2-GCIB etching with acetic acid at an incident angle of 70^o.

Keywords: GCIB; acetic acid, STT-MRAM; oblique incidence

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