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Formation of CCP-NOL for MR enhancement in CPP-Spin Valve structures

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For the MR enhancement in CPP-GMR(current perpendicular to plane – giant magetoresistance) spin valve structure, a CCP(current confined path)-NOL(nano-oxide layer) of AlO_x was deposited on the Cu layer of half spin valve architecture [sub.(Si/SiO_2) / Buffer / Cu(200) / MnIr(100) / CoFe(40) / Cu(20) / NOL, in Å unit] by oxygen reactive sputtering of Al with IR heat treatment (200~300°C), and subsequently etched by Ar ion to make punched-through holes at grain boundaries of AlO_x. Deposition conditions of AlO_x, including ambient oxygen pressure (P_{O2}) and substrate temperature, were systematically controlled to produce a granular insulating oxide layer without oxidizing bottom layers. The thickness of NOL layers was varied from 6 to 28 Å. To make punched-through holes down to the Cu under-layer, a slight *in-situ* Ar ion etching was performed on the NOL with RF bias of 20~30W and etching time of 3~30sec. Conducting AFM analysis on the surface of the films revealed that conducting paths were formed at dominantly etched grain boundaries of NOL.

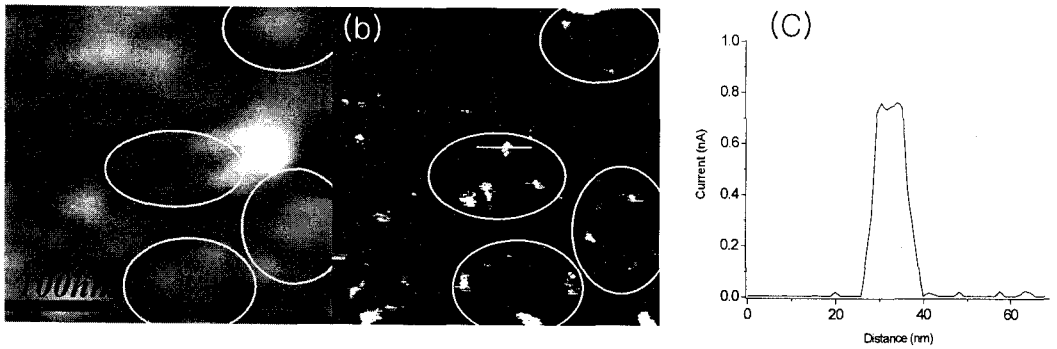

Fig.1 Topography (a) and corresponding current image (b) of etched NOL surface made by conducting AFM. Bright parts in current image (conducting paths) correspond to dark region (around grains) in the topography. A line profile along the line marked in image (b) is presented(c).