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Changes in Aspect Ratio and Geometric Axis Orientation of Crystalline Grains of $Ni_{80}Fe_{20}$ Electrodeposited on Nanostructured Copper Cathodes

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Abstract.

$Ni_{80}Fe_{20}$ films (t=15nm) were electrodeposited on a nanostructured copper sheet [Ref.1]. Multistep electropolishment of the sheet ensured rms roughness ~7nm over 50x50μm^2 areas [Ref.2]. Parallel scratches arise (Fig.1) mechanically polishing copper unidirectionally (#9μm diamond paste). Fig.2. shows a typical cross section. Scratches of interest are approximately dihedral with medium deepness ~ 100nm and medium top width ~1000nm (β~2*arctan*(5)) [Ref.3]. Electrodeposition on resulting spatial charge distribution implied on elongation of grains and orientation of its main axis parallel to scratching direction (Fig.4). Fig.3. shows the isotropic aspect ratios and orientation of an equivalent film, deposited on a non-structured copper evaporated film.

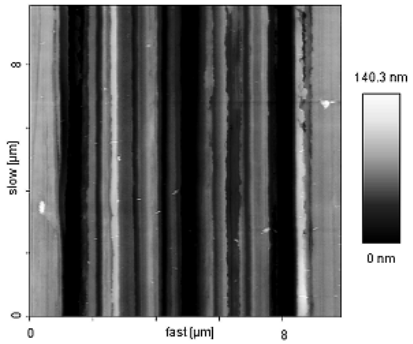

Figure 1: AFM image of a nanostructured copper sheet with parallel scratches.

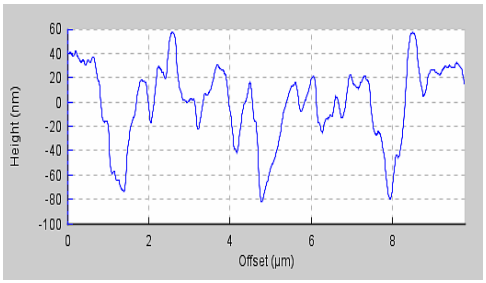

Figure 2: Typical cross section of the parallel nanoscratches on copper.

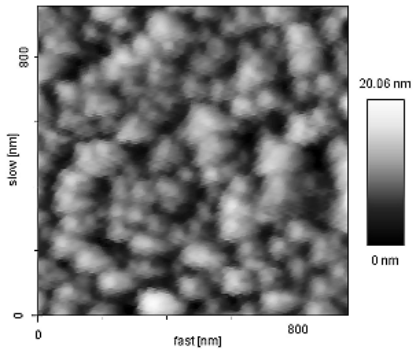

Figure 3: AFM image of a typical isotropic grain morphology of a 15 nm $Ni_{80}Fe_{20}$ film electrodeposited on a flat Cu evaporated film.

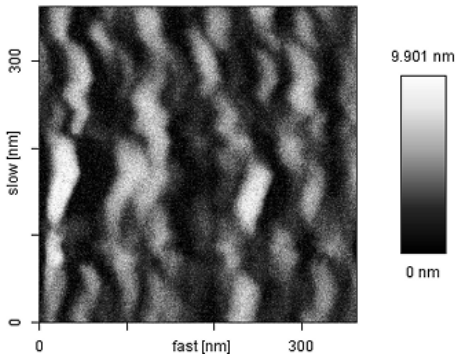

Figure 4: AFM image of the annomalous morphology of a 15 nm $Ni_{80}Fe_{20}$ film electrodeposited on a nanostructured Cu substrate, showing one of the internal faces of a dihedral, with elongated grains aligned parallel to scratches.

References

[1] Quemper, J.-M. et al., Sensors and Actuators 74, p.1–4, 1999.
[2] Gomes Filho, J. et al, "Improvement of Copper Electropolishing Using a Multistep Method", CBSMM 2007 (submitted)
[3] Jackson, J.D, "Classical Electrodynamics" , John Wiley & Sons, 2nd Ed., p. 75, 1975.