

Abstract Submitted
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X-Ray Diffraction Studies of CoFeB/MgO/CoFeB Magnetic Tunnel Junctions PINSHANE HUANG, Carleton College, JOHN READ, ROBERT BUHRMAN, Cornell University — MgO-based magnetic tunnel junctions (MTJs) show high levels of tunneling magnetoresistance (TMR),¹ a very desirable trait for magnetic random access memory and hard drive read heads. Because theory links tunnel junction crystallinity with high TMR, studies of MTJ crystal structure have implications for the development of high-performance MTJs^{2,3}. Varying the anneal temperature, MgO growth methods, and seed layers, we have examined texturing in CoFeB/MgO/CoFeB tunnel junctions using x-ray diffraction. We investigated MTJs with rf-sputtered or electron-beam evaporated MgO barrier layers, and we used TaN, Ta/Ru, and Ta/CuN as alternative seed layers for the MTJ growth. We report on changes in both tunnel barrier and electrode crystallization as a function of anneal temperature, which we find to be dependent on both the MgO deposition method and the seed layer composition. Our complete MTJ structures using rf-sputtered MgO barriers achieve TMR in excess of 200%, and correlation with these XRD results sheds light on the complex dependence of MTJ performance on growth and processing conditions.

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²J. Mathon and A. Umerski, Phys. Rev. B. 63, 220403 (2001).

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