Effect of pulsed magnetic field annealing on the resistance switching property of Fe- and Co- doped ZnO thin films

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The 5% Fe doped ZnO (ZnO:Fe) thin films were deposited on Pt/TiO2/SiO2/Si substrates by spin-coating. The effects of magnetic annealing on resistance switching (RS) performances were investigated by annealing the films with (ZnO:Fe-4T) and without (ZnO:Fe-0T) a pulsed magnetic field of 4T and analyzing the consequent electrical characteristics respectively. As compared to the films without magnetic annealing, the magnetic annealed films showed improved RS performance regarding the stability of the set voltage and the resistance of the high resistance state. The transmission electron microscopy and x-ray photoelectron spectroscopy analyses on the 5% Fe doped ZnO (ZnO:Fe) thin films revealed that the ZnO:Fe-4TP film contains more uniform grains and higher density of oxygen vacancies, which promote the easier formation of conducting filaments along similar paths and stability of switching parameters. Likewise, the 1% Co doped ZnO (ZnO:Co) devices fabricated by the same methods also revealed the superiority of magnetic annealing when compared the RS of ZnO:Co-4T films with the ZnO:Co-0T films. These results suggest that the external magnetic fields can be utilized to prepare magnetic oxide thin films with improved resistance switching performance for memory device applications.