

Method to Achieve Low and Stable Ferromagnetic Coupling Field

Abstract of the Disclosure

A method for making spin valves (100) with low and stable coupling field includes the oxygen exposure steps. In this method, a first ferromagnetic layer (106) is deposited onto a substrate (104) using an ion beam sputtering process. The first surface (109) of the first ferromagnetic layer (106) is exposed to an oxygen-rich atmosphere with oxygen partial pressure of about 5×10^{-6} Torr. Oxygen is physisorbed on the first surface (109). The oxygen partial pressure rapidly decreases before a spacer layer (110) of about 20Å thick copper is deposited onto the first oxygen treated surface (109). The spacer layer (110) has a second surface (111), which is treated with oxygen with a process similar to the process for treating the first surface (109). The oxygen partial pressure rapidly decreases before the second ferromagnetic layer (112) is deposited onto the second oxygen treated surface (111). Surface adsorption of oxygen limits the intermixing between the layers and reduces the surface roughness of these surfaces, which results in reducing the coupling field of spin valves. The coupling field is extremely stable upon hard bake anneal. The magnetoresistive ratio also is significantly enhanced. This method can be applied for top and bottom simple spin valve, top and bottom AP-pinned spin valve, and dual spin valve.

Fig. 1