Exchange assisted spin transfer torque switching

XI CHEN, Physics Department, University of Minnesota, RANDALL VICTORA, Electrical Engineering Department, University of Minnesota — The main challenge in the application of spin transfer torque switching is the high current required to reverse the magnetization. We propose a composite structure containing soft and hard magnetic layers that significantly lowered the switching current. The dynamic phase diagram of the structure is studied using a macrospin model, with Landau-Lifshitz-Gilbert equation including a spin torque term. It is shown that an optimal exchange coupling strength exists with a value around half the anisotropy of the hard layer. By using multiple soft layers with graded anisotropy, a further reduction can be achieved. We also show that the switching current grows linearly with the damping constant in the soft layer. This means that a low damping, soft material can facilitate the reversal of the hard layer and reduce the switching current by over an order of magnitude.

Xi Chen
Physics Department, University of Minnesota

Date submitted: 30 Nov 2008