Chapter 1 Introduction

The exchange bias phenomenon has been of great technological importance because of its use in spin valve devices and magnetoresistive random access memory (MRAM). Recently, MgO-based magnetic tunneling junctions (MTJ) have attracted a great deal of attention due to their high tunneling magneto-resistance (TMR) ratios [1]. The crystalline quality of the MgO (100) barrier is an important factor to the TMR ratio. In order to obtain highly textured (100) MgO barrier, a structure with a (001) antiferromagnetic (AFM) layer is preferred. In this study, we demonstrate a promising approach to fabricate epitaxial (001) IrMn/ $Co_{50}Fe_{50}$ bilayers by using the epitaxial Cu underlayers on Si substrates, instead of the previously reported MgO substrates [2]. Furthermore, the highly conductive Cu underlayers can be used as bottom leads in MTJs. In addition, the behavior of magnetization reversal is complicated in the (001) epitaxial AF/FM systems such as NiFe/FeMn [3], NiFe/NiO [4], Co/NiMn [5,6], Fe/MnPd [7], so asymmetric loops or double shifted magnetization curves were observed due to the competition of anisotropies. In this study, we qualitatively analyzed the anisotropies in epitaxial (001) IrMn/CoFe by using Stoner-Wohlfarth model [8], and magnetization reversal was studied.