Abstract

The ordering temperature of FePt films grown on PtMn underlayers was reduced due to phase transformation of the PtMn $L1_0$ phase. The in-plane coercivity of 10 nm FePt on 50 nm PtMn underlayers was 7688 Oe after annealing at 325°C. An exchange field of 554 Oe was also observed, which indicates that PtMn may not only induce the ordering of FePt at a reduced temperature, but also may provide extra anisotropy.

We then use MgO (001) substrates to grow perpendicular PtMn/FePt films. The presence of PtMn eliminates the strip domains, observed in (001) FePt directly grown on MgO, and forms special rectangular domains. As the thickness of the FePt increases, the switching behavior of samples with PtMn underlayer changes from rotation dominant type to the domain wall motion dominant type. On the contrary, samples without PtMn layer show domain wall motion dominant type for all thickness we studied. As the thickness of FePt reaches 50nm, sample shows strong vertically correlated magnetization reversal due to the large static magnetic energy. The coercivity of all samples are enhanced by inserting the PtMn layer. The enhanced coercivity is related to the changes of the morphology and exchange coupling between antiferromagnetic PtMn and FePt. Moreover, we found that the PtMn/FePt samples form special graded anisotropy profile in which the soft layer is in the middle of the magnetic layer. Therefore, the PtMn underlayer can induce the ordering of FePt and is also a good underlayer for perpendicular growth of FePt. Moreover, the diffusion of Mn from PtMn makes the FePt become a graded media, in which a soft layer is formed and helps the magnetization reversal of the FePt layer.

摘 要

本論文主要研究錳白金底層對於鐵白金合金性質之影響。在第一個部分我們發現錳白金底層能夠促進鐵金之低溫相變化。我們將錳白金底層與鐵白金一同鍍製在二氧化矽的基板上，我們發現厚度為10奈米的鐵白金長在50奈米的錳白金底層上在325°C 退火處理後，水平的矯頑磁場為7688 Oe。另外，我們也觀察到 554 Oe 的交換場，這表示錳白金除了能夠促進鐵白金的低溫相變之外，還提供了額外的異向性能來增加鐵白金的矯頑磁場。

之後，我們利用氧化鎂(001)的基板來成長具有垂直異向性的鐵白金薄膜。我們發現，利用錳白金底層能夠消除單純鐵白金長在氧化鎂基板上所出現的長條狀的磁域，並形成特殊的方塊型磁域。當成長在錳白金底層的鐵白金的厚度由12.5奈米逐漸增厚之後，其磁性翻轉的機制由原本的回轉模式為主轉變成由磁域壁移動所主導的翻轉機制。然而在沒有錳白金底層的樣品，我們發現其翻轉機制都是由磁域壁移動所主導。所有鐵白金的矯頑磁場都因為加了錳白金的底層而上升，這是因為錳白金的底層改變了鐵白金的成長機制進而改變其表面形貌，另外錳白金也提供了一個額外的異向性能，因此改變了鐵白金的矯頑磁場。

最後我們研究錳白金以及鐵白金這個雙層結構縱向的異向性能的分佈，我們發現由於錳的擴散以及反鐵磁性的錳白金提供額外異向性的緣故，此一雙層結構呈現中間軟而上下硬的異向性分佈。此為一漸進式媒體所需要的結構。