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半導體材料奈米結構的磁區研究

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摘要

本研究是以磁力顯微鏡觀察半導體材料鍺、矽之奈米結構的磁區。因半導體材料奈米結構的磁性表現並非一般鐵磁材料，所以使用磁力顯微鏡所得到的磁區影像和鐵磁材料有明顯的差異。且由先前研究結果得知，奈米尺寸的半導體材料為軟磁，使得探針本身的磁力在觀察過程中會影響磁區結構，因此我們利用不同的磁力探針(硬磁、軟磁)去量測磁性結構。在使用硬磁針觀察時，剛開始觀察到的磁區較小，在一段時間過後磁區會加寬。軟磁針則在一開始就會看到較寬的磁區，也較易量測到原子力的部份。藉由外加場的改變觀察磁區的變化，會觀察到加場後磁區影像在移動，外加場關掉後磁區會回到原位置。我們也比較不同磁性強弱樣品的磁區差異，希望可以更進一步了解這些樣品真實的磁區結構。

關鍵詞：磁力顯微鏡、磁區

The Study of the Magnetic Domain Structure of Nanostructured Semiconductor Materials

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Abstract

In this study, magnetic domain structures of the semiconductor nanostructures (Ge, Si) were studied by magnetic force microscope (MFM). The distinct differences on the domain structures in MFM images were observed due to the non-traditional ferromagnetic nature of the semiconductor nanostructures. From previous experimental results, it was shown that the soft magnetism of semiconductor nanostructures was heavily affected by the measurement procedure. By using different (hard and soft) magnetic tips and applying parallel fields to the sample, we have tried to obtain the exact domain structures and avoid the noise originating from measurement and magnetic tip. With hard magnetic tips, magnetic domains were widened after sometime. However, wide domain structures were always observed with partial atomic force contributions by using soft magnetic tips. By varying the external magnetic fields, the back and forth moved domain patterns were observed. We have also compared with different samples in order to find the true magnetic domain structures.

Key words: AFM, magnetic fields