以掃描式探針顯微鏡製作高溫超導量子干涉元件之特性研究

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摘 要

本研究利用掃描探針顯微鏡(Scanning probe microscopy)之微影蝕刻技術(Lithography)，用以製作約瑟夫森穿隧元件之弱連接處，並且改變製作時探針偏壓大小與掃描速率以研究其特性變化。實驗中使用離軸式射頻磁控濺鍍(RF magnetron sputtering)系統，以SrTiO3 (100)為成長基材，成長薄膜厚度150 nm之高品質釔鋇銅氧超導薄膜，再利用X-ray晶格繞射儀(XRD)與原子力顯微鏡(AFM)做薄膜特性量測。而圖形製作方面，則是利用光學微影技術(Photolithography technology)與離子蝕刻技術(Ion etching)製作出3 μm微橋圖形。

當我們施加偏壓超過一個臨界值時，薄膜表面將會成長出奈米級氧化線，而依照陽極氧化作用原理，隨著掃描速度的改變，所生成的氧化物寬度與高度也會有所變化。在電阻對溫度特性曲線量測結果發現，在接近超導態時有因弱連結引起正常態/超導態之展緩變化行為，顯示此技術對於未來製作超導量子干涉元件(SQUID)有更進一步成功的可能。

關鍵詞 : 高溫超導、掃描探針顯微鏡、原子力顯微鏡微影蝕刻技術、超導量子干涉元件

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