2016 中技社科技研究獎學金

CTCI Science and Technology Research Scholarship

通電對材料相平衡的影響

On the lattice stability of alloys and metal under electric current

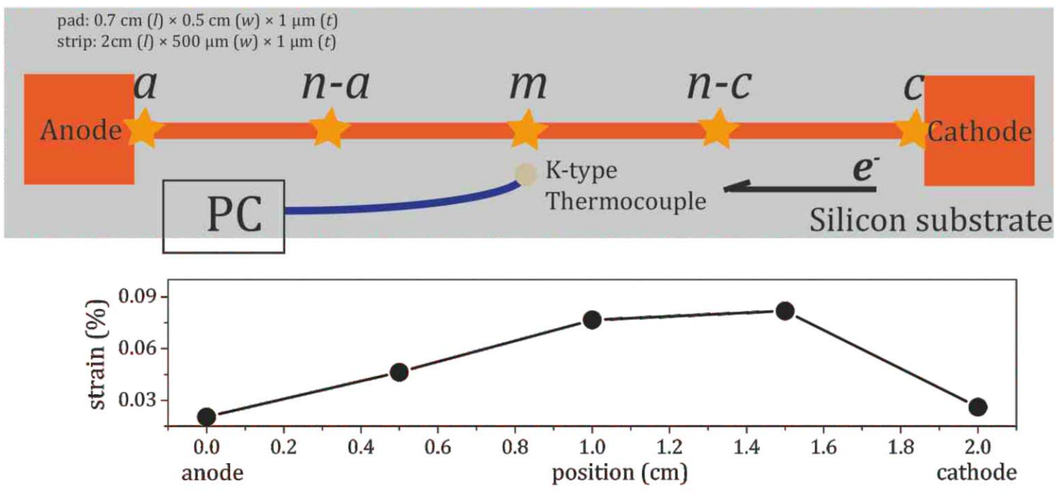
國立成功大學 材料科學及工程學系 博士班三年級 劉禹辰

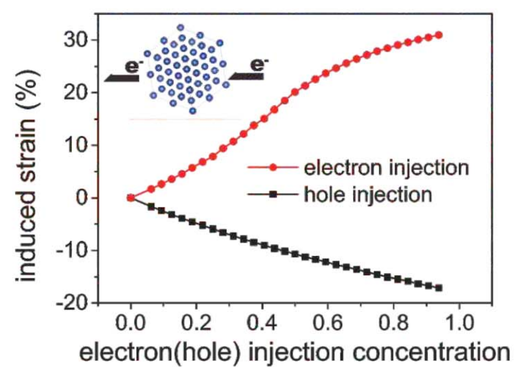
指導教授：林士剛 博士

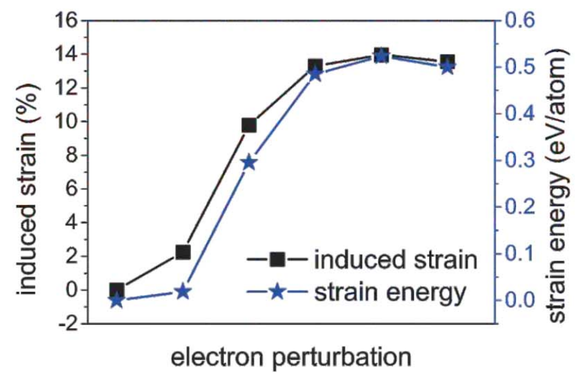
研究重點

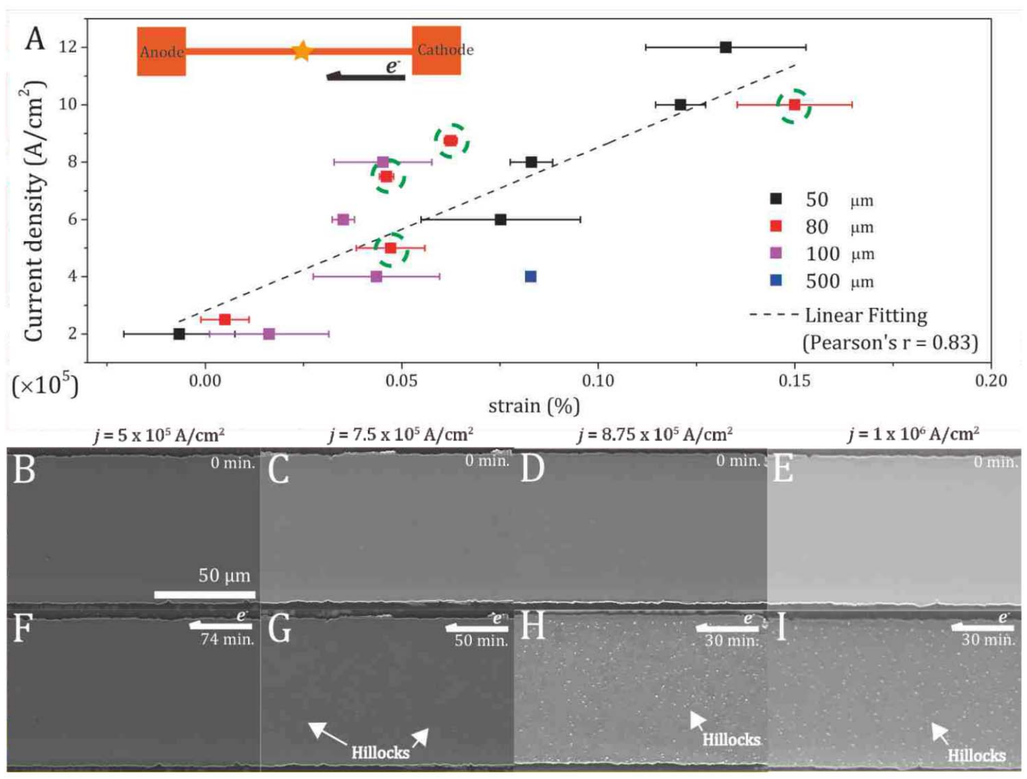
The electromigration (EM) effect involves atomic diffusion of metals under current stressing. Recent theories of EM are based on the unbalanced electrostatic and electron-wind forces exerted on metal ions. However, none of these models have coupled the EM effect and lattice stability.
Here we performed in situ current-stressing experiments for pure Cu strips using synchrotron X-ray diffractometry and scanning electron microscopy and ab initio calculations based on density functional theory. An intrinsic and non-uniform lattice expansion – larger at the cathode and smaller at the anode, is identified induced by the flow of electrons. If this electron flow-induced strain is small, it causes an elastic deformation; while if it is larger than the yield point, diffusion as local stress relaxation will cause the formation of hillocks and voids as well as EM-induced failure. The fundamental driving force for the electromigration effect is elucidated and validated with experimental observations in the literature.

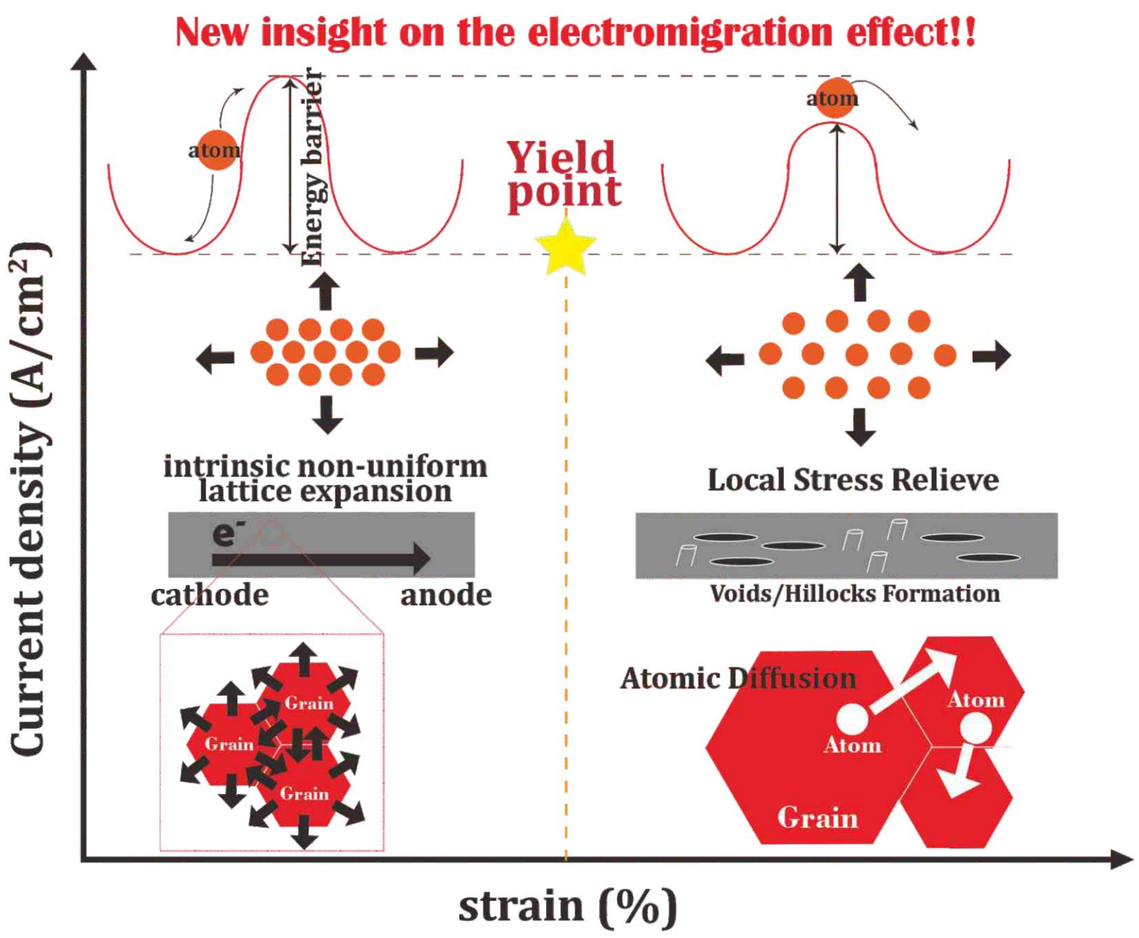
研究成果











研究生活及心得

從大三當專題生開始便加入林老師實驗室執行國科會大專生計畫，至今已是第五年的開始，時常都記得林老師常說做研究就像是在挖寶藏一樣，過程必然經歷挫折，但也都是一種學習，除了學習獨立執行研究一項計畫之外，也學習如何做一個更好的人。很感謝林老師的指導，從剛進來什麼都不會，實驗、模擬也都做不出點成績，老師花了很多時間除了指導之外，也與我們鼓勵、建立自信心。感謝爸爸媽媽的栽培，爸媽從不在我的求學裡給予壓力，任由我恣意發展，是我最棒的後盾！感謝中技社的肯定，能獲此獎項是很大的一項殊榮。

Novel EXperimental & Theoretical Group for materials design

財團法人 中技社 CTCI FOUNDATION