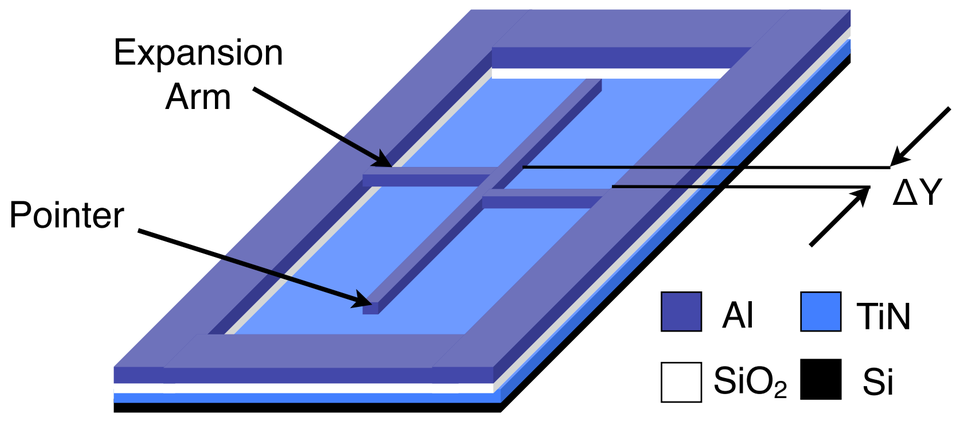
Micromechanical Test Structures to Measure the Stress in Electroplated Permalloy

Introduction

★ The microrotating test structure consists of two fixed expansion arms supporting a suspended pointer arm.



★ Stress in the material causes the pointer arm to rotate when the structure is released.

★ The direction will depend on whether the residual stress is compressive or tensile.

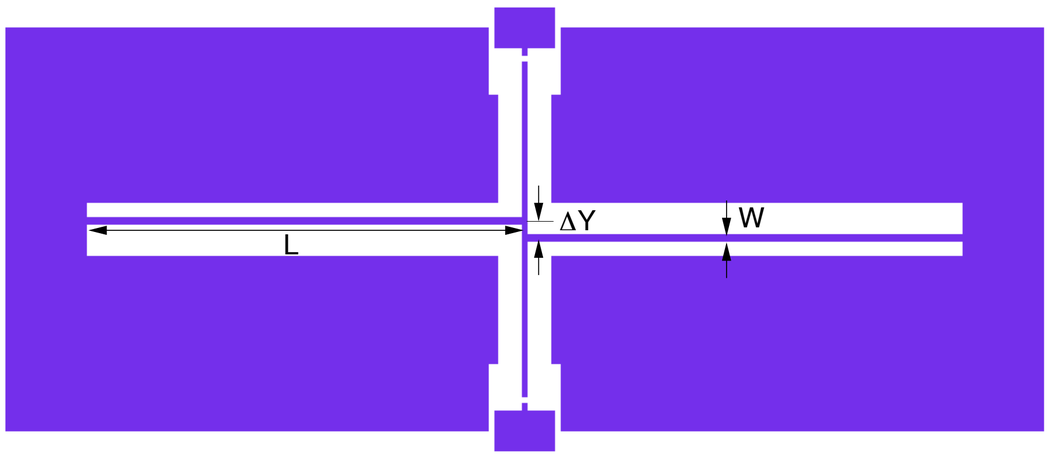
★ Test structures can be applied to a wide variety of different materials.

Test Structures

★ Electroplated “Permalloy” (NiFe alloy) can be used to fabricate magnetic MEMS

★ Characterisation of the stress in thick permalloy is important for integration.

★ Test chip designed to determine the best dimensions for test structures.



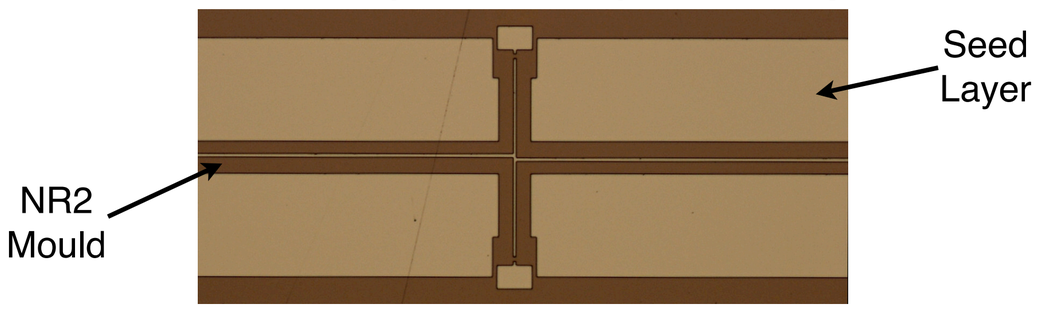
★ Expansion arm lengths L: 650 to 850µm

★ Expansion arm widths W: 5 to 10µm

★ Arm separation ratio ΔY/W: 0.5 to 5

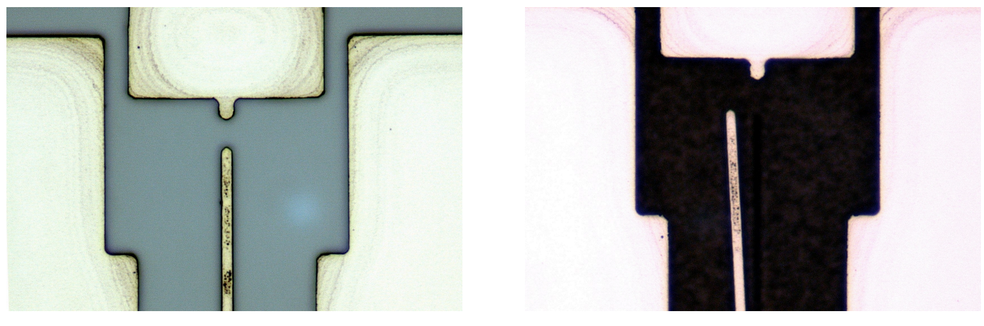
Fabrication

★ A thick photoresist (NR2) is used as a mould to electroplate the permalloy.



★ After electroplating the photoresist is removed along with the seed layer.

★ Finally the structures are released using a XeF_2 vapour etch process.

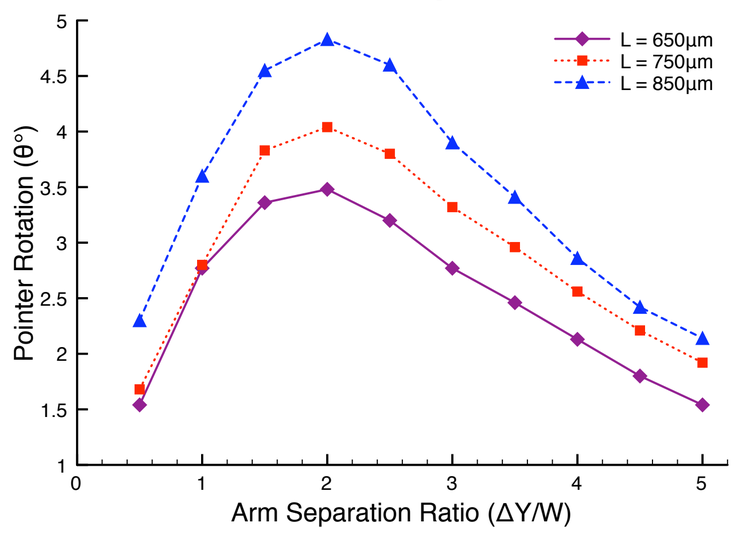


Before Release

After Release

Results and Conclusions

★ Rotations are extracted from images of released structures and plotted vs. ΔY/W.



★ The rotation increases with expansion arm length.

★ The maximum rotation is observed on structures with ΔY/W = 2.

★ These results will inform the layout of a mask with optimised test structures to characterise the stress across an 8” wafer.

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