

FIB(Focused Ion Beam)의 원리 및 활용



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Introduction

Application

Imaging

Circuit Modification

TEM Sample preparation

3D structure fabrication

Summary

Why use the FIB

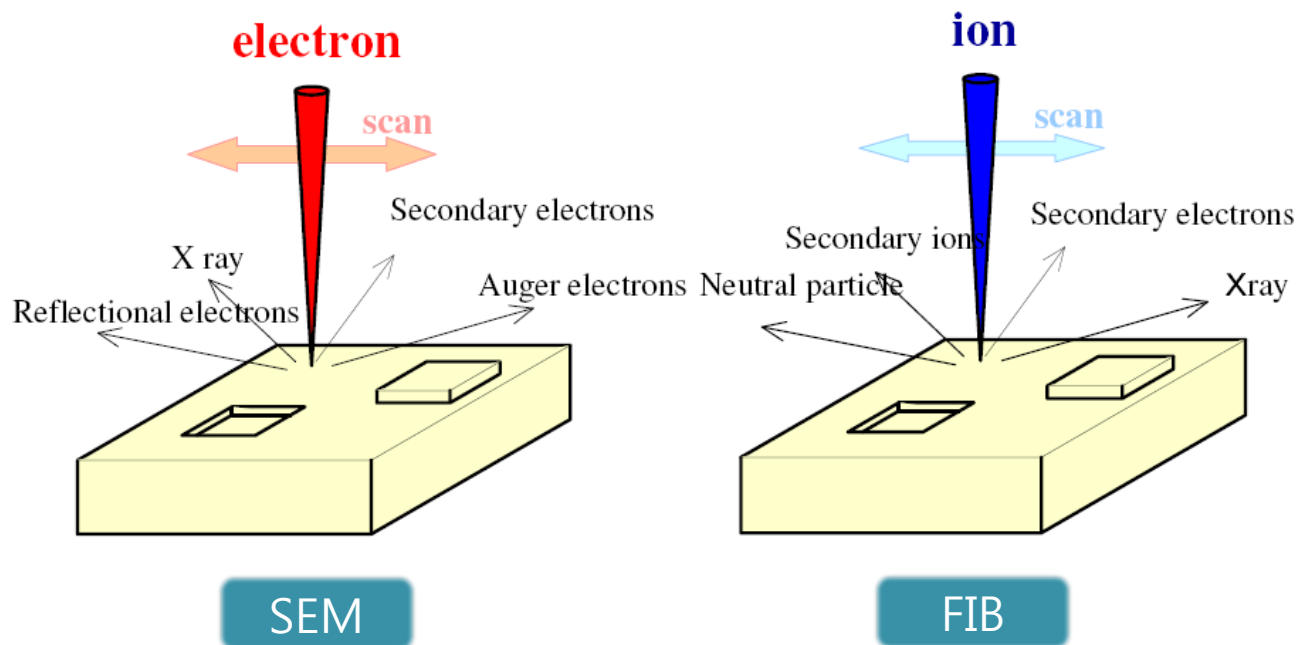
FIB is a scanning microscope

FIB is a milling machine

FIB can deposit materials and chemical enhanced etching

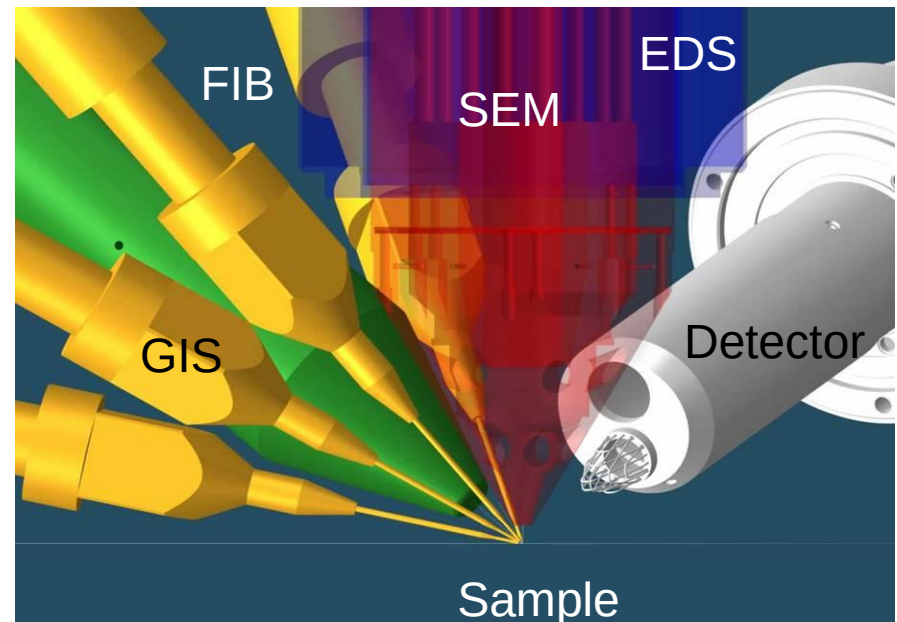
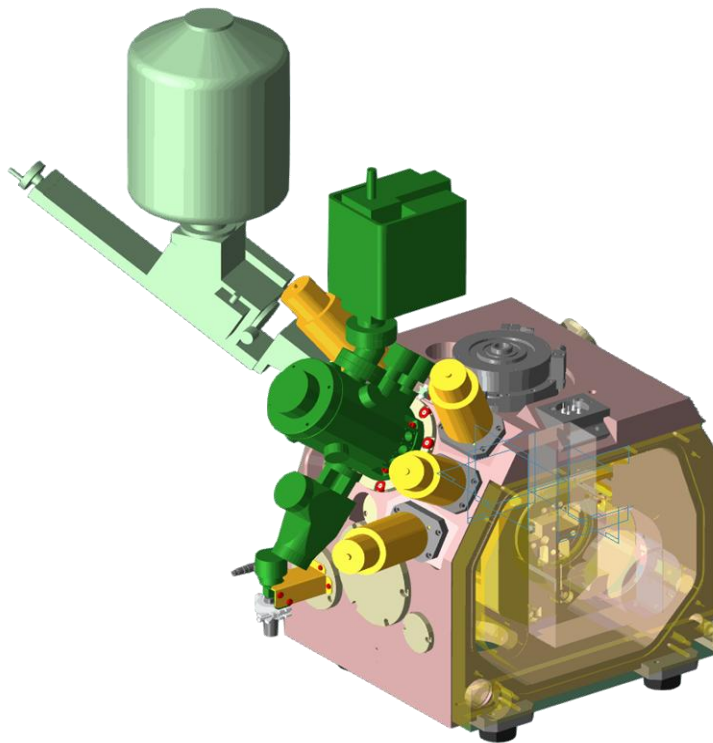
FIB can prepare TEM Sample

What is the FIB different from SEM?

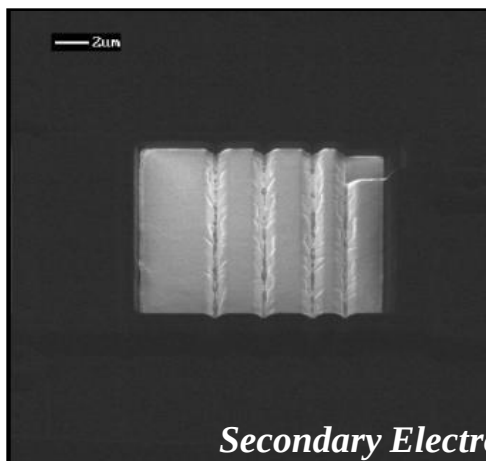


Combines high magnification imaging (SEM) and sample modification (FIB)

FIB Structure

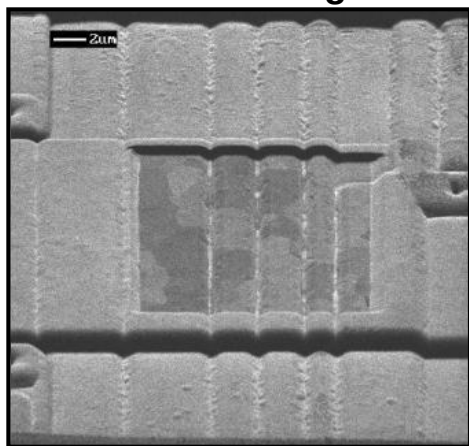


FIB Imaging



Secondary Electron

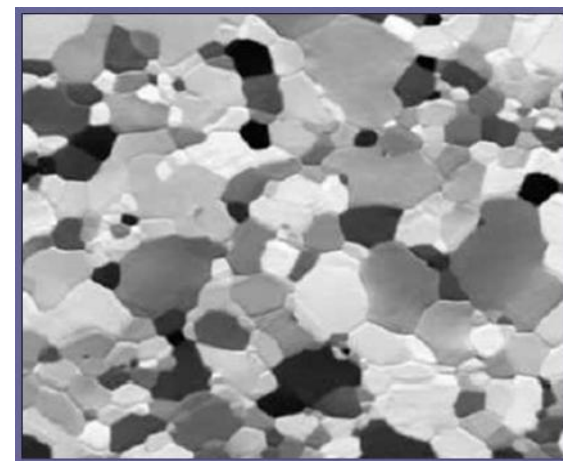
SE mode Image



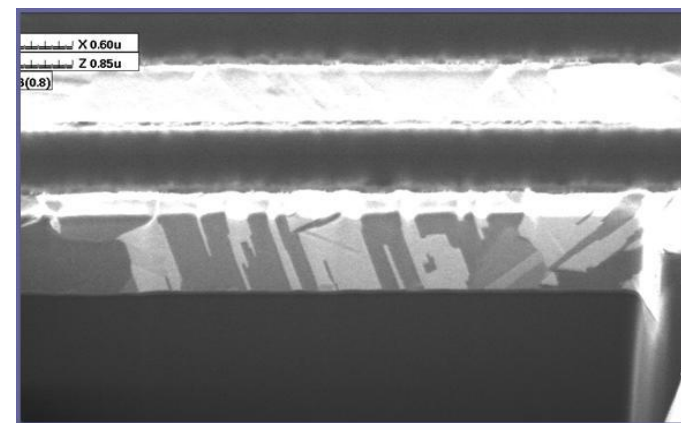
SI mode Image



Channeling Contrast (Au)



Channeling Contrast (Al)

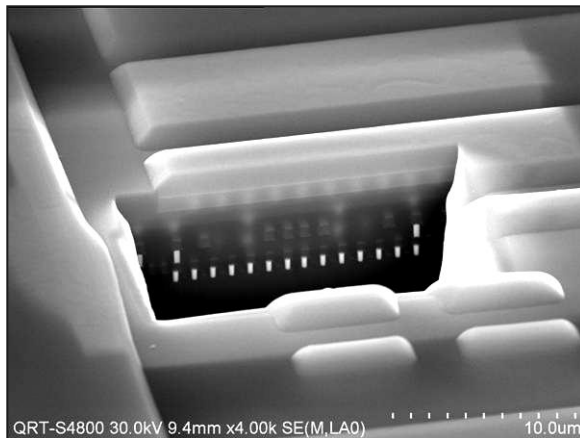


Channeling Contrast (Cu)

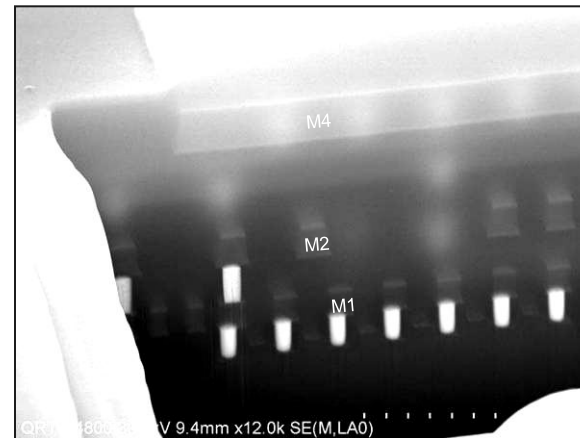
Circuit Modification



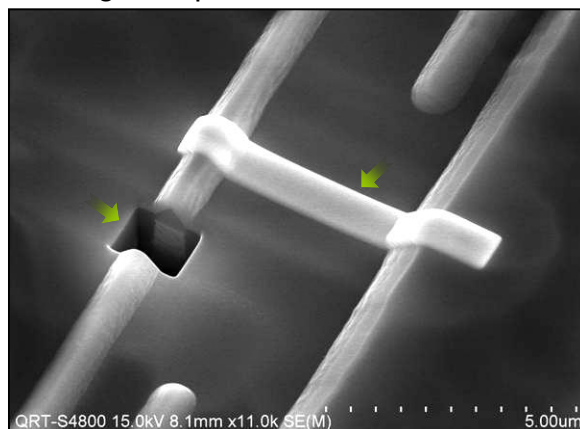
Cross Section



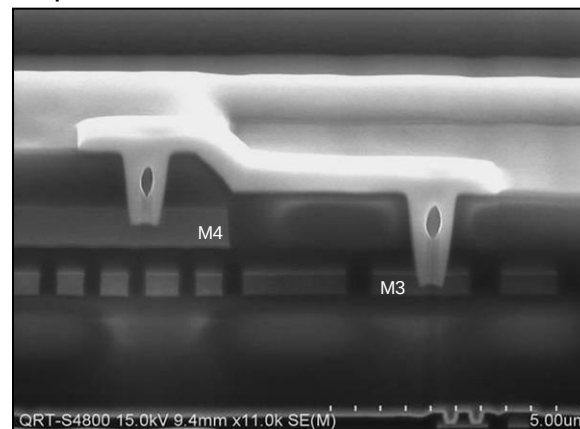
Enlarged



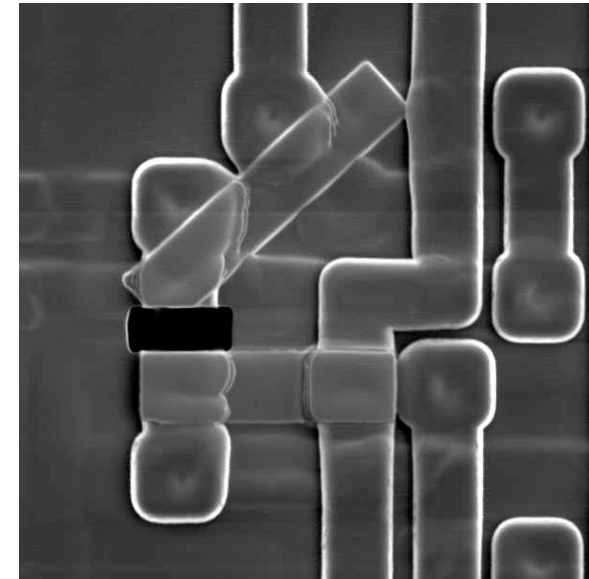
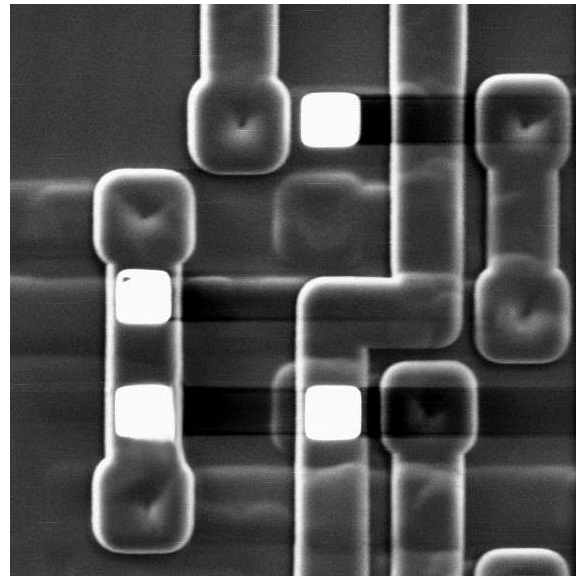
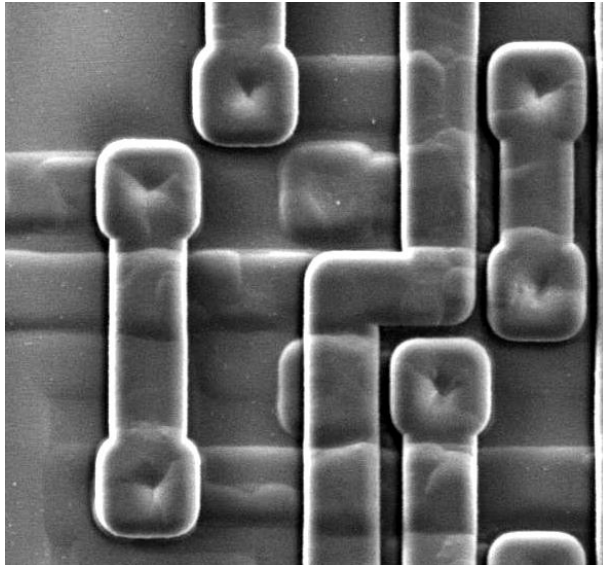
Cutting & Deposition



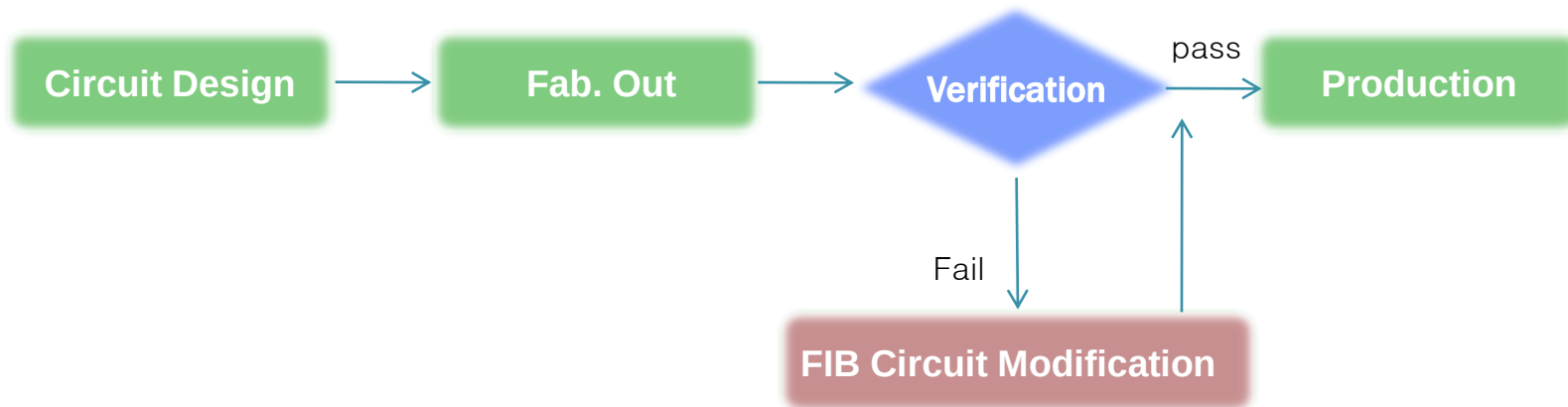
Deposition Profile



Circuit Modification Example



The Value of Circuit Editing



Copper Metal Edit



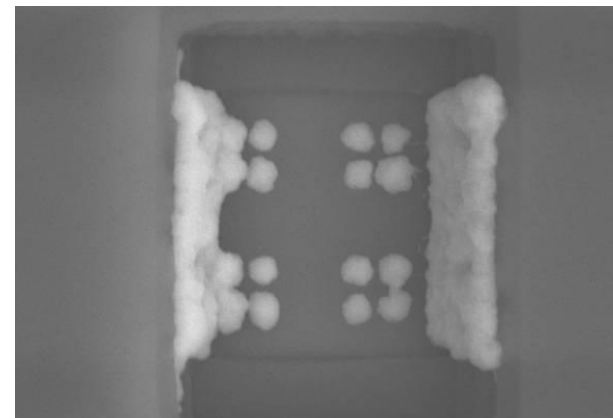
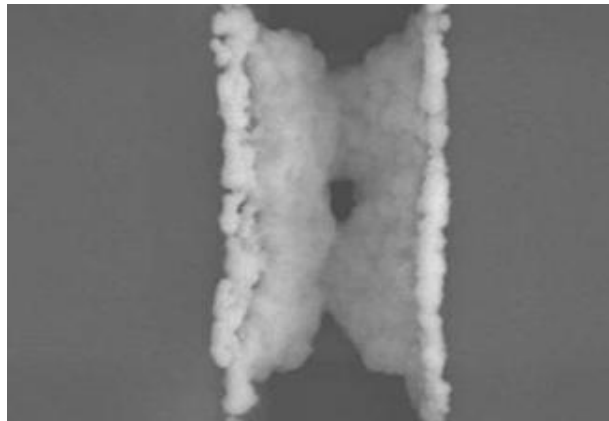
◆ Halides($\text{Cl}_2, \text{Br}_2, \text{I}_2$) typically used for Aluminum GAE are not suitable for copper because:

! They do not form volatile compounds with copper

! They leave behind conductive material

! Cause corrosion of any exposed copper across the whole chip

◆ No other appropriate chemical known to volatilize copper at room temperature



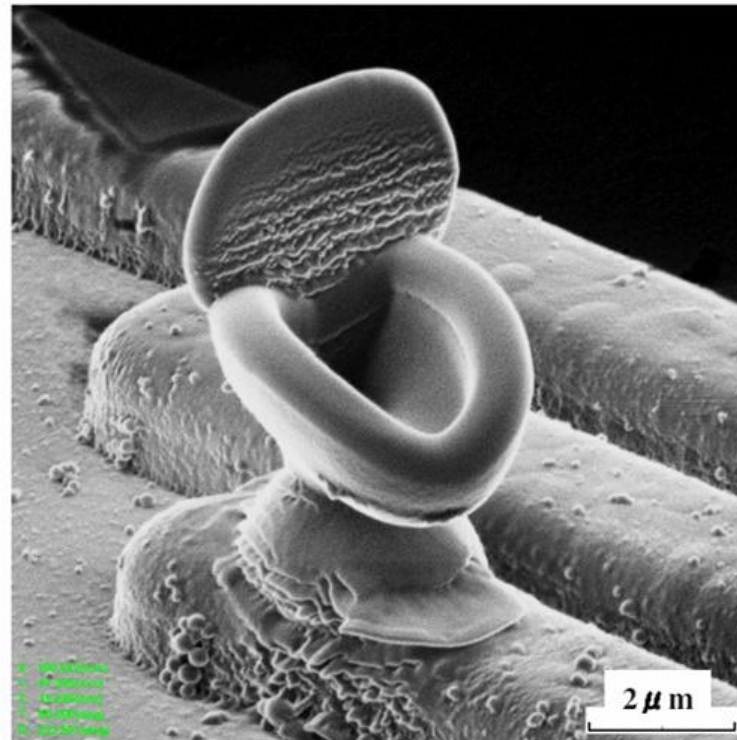
Fabrication using CAD Data



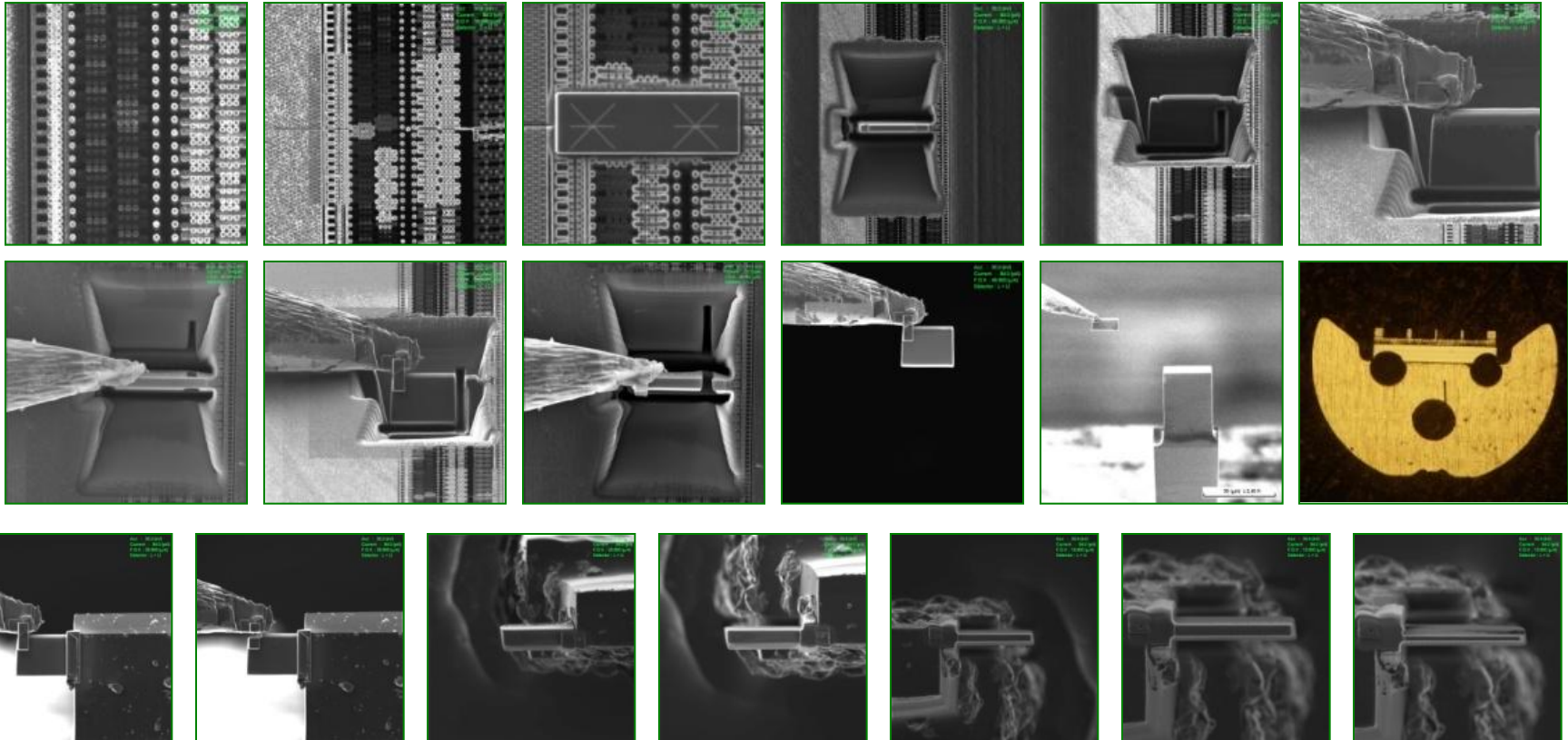
Nano-toilet



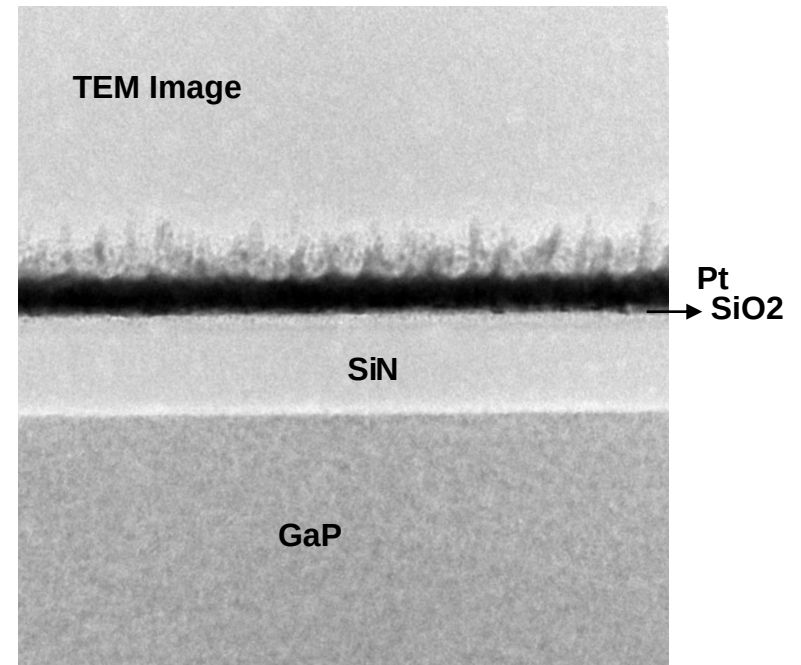
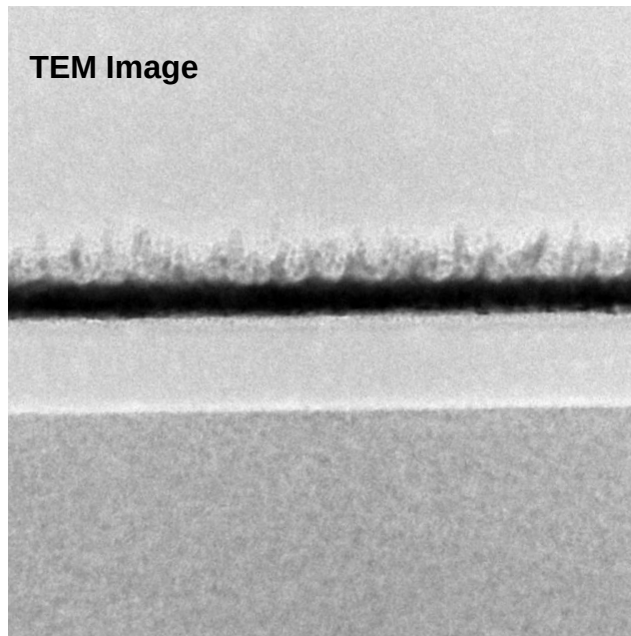
30kV, Ga+, 9pA
Bitmap:100 sheets
Sample : Si wafer



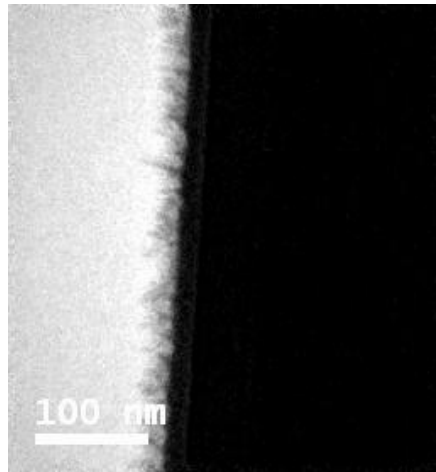
TEM Sample Preparation Procedure



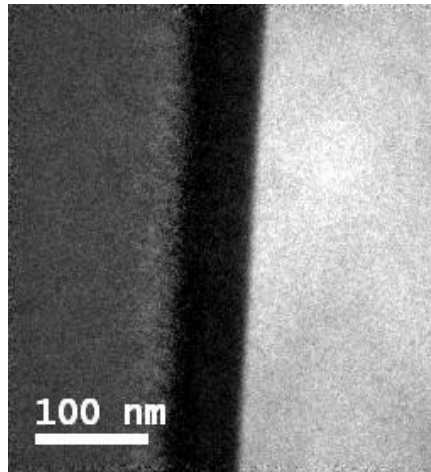
TEM Image (LED)



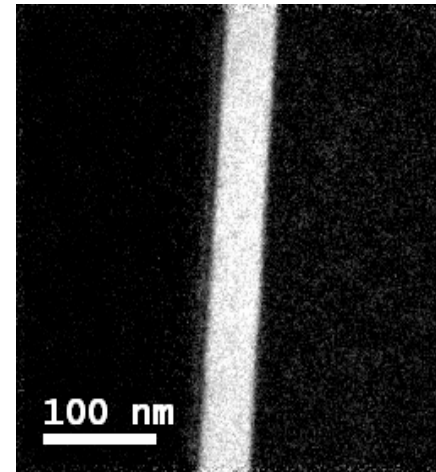
EELS Data



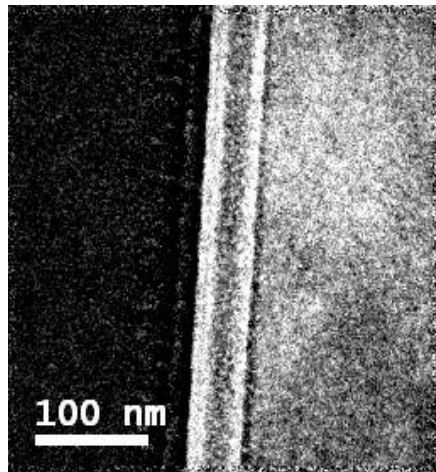
C



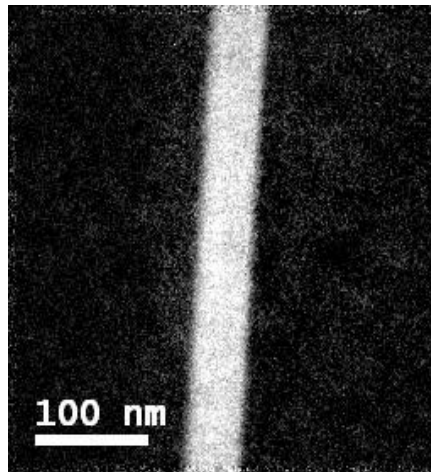
Ga



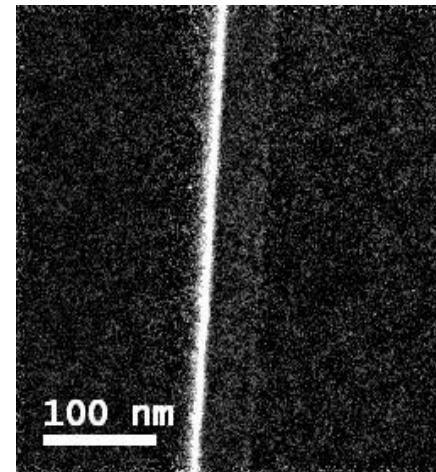
N



P



Si



O

Summary

Circuit Modification

Maintain Critical time to market
Lower cost

TEM Sample Preparation

Without breaking wafer
Quick Sampling
Consistency

Failure analysis

Cross Section
Voltage Contrast



Thank You !

For more Information

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