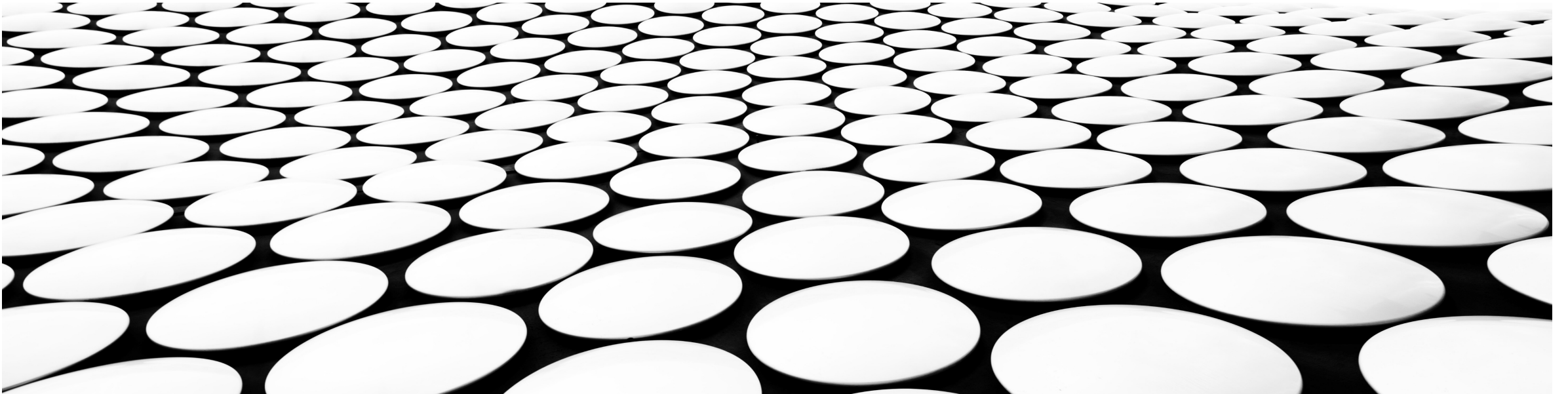


MTTC TOUR PRESENTATION

SEMICONDUCTOR MANUFACTURING CAPABILITIES

A COMPLIMENTARY ENGINEERING PERSPECTIVE

BERNARDO MARTINEZ-TOVAR, PH.D., RESEARCH ENGINEER



BMT's INTRODUCTION/BACKGROUND

1992

CHTM -> PhD in EE
Electrothermal Transients in
Semi-Conductor Bridge (SCB)
Devices
Dissertation's experimental
work done at SNL

In the beginning

1993 - 1995

PI & first employee of
SCB Technologies
Local start up company
commercializing the SCB
Technology created at SNL

Incorporation to Industry

1995 - 2019

Technical Mgr. of SCBT Ops for
Ensign-Bickford Aerospace &
Defense Company
Production of SCB Initiators for
commercial and specialty
applications for the initiation of
advance energetic materials.

Professional Experience

BMT'S BACKGROUND (CONTINUATION)

2019-2022

Created AlambriC LLC
To provide IC assembly and technical services for local companies
To continue his own R&D on SCB Initiators

On his own

2023 - to date

Joined MTTC-UNM
To support Dr Pleil's activities in teaching and developing advanced semiconductor processing for students and external users.

Incorporation to academia

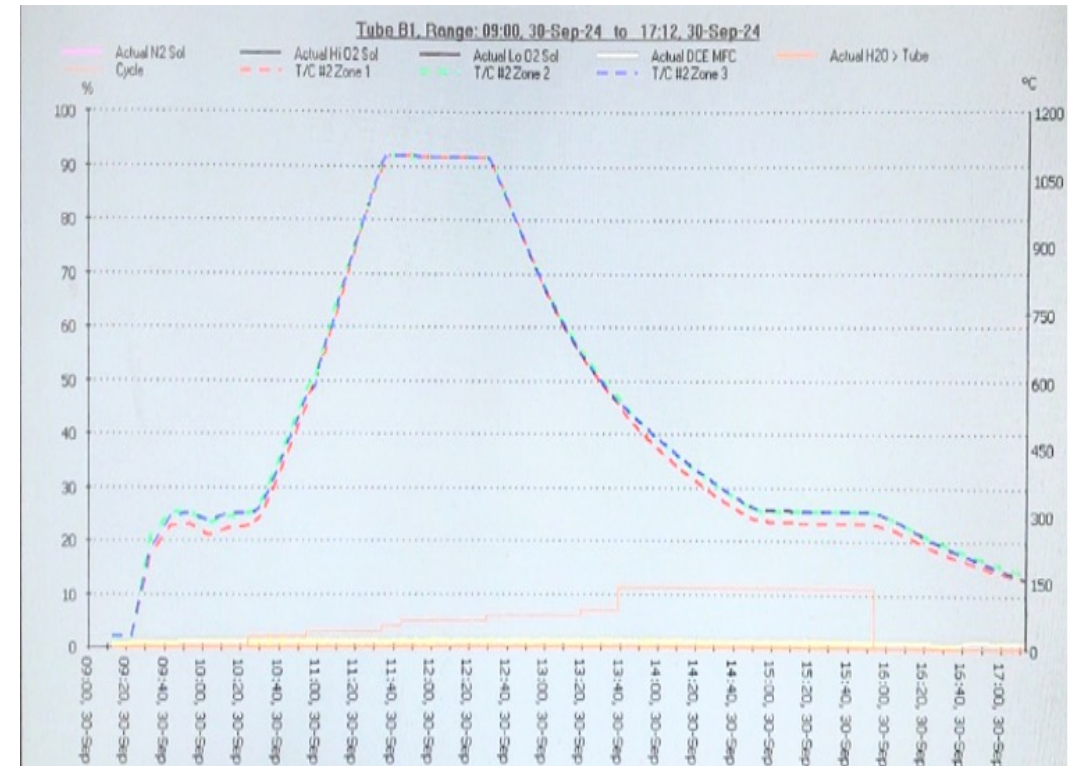
2024 - 2026

Bringing businesses to MTTC
Aerospace Industry,
Automotive Industry (LED-Headlight Assy), Oil & Gas Exploration and Others...

Current activities

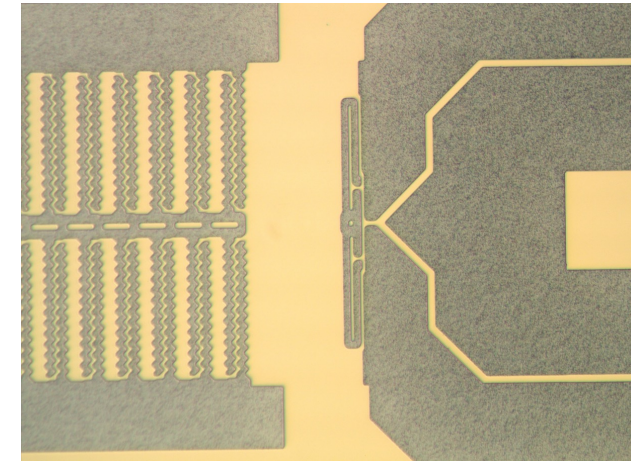
SEMICONDUCTOR PROCESSES AT MTTC

- Equipment and wafer processing characterization
 - Thermal Oxidation, dry and wet oxide growth with computerized Temp-time profile recipes.
 - Thermal Diffusion of Phosphorous & Boron by using Planar Doping Sources and computerized Temp-time profile recipes.
 - Annealing in O₂, N₂, FG from 350 – 1100 C
 - Single wafer and batch processing.
 - Up to 6” diameter substrates capability

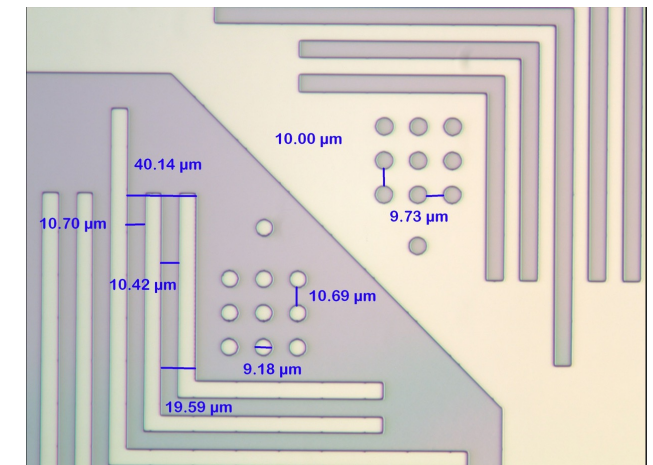


SEMICONDUCTOR PROCESSES AT MTTC

- Equipment and wafer processing characterization
 - Transference of CAD layout onto substrates
 - PR-Patterning with various types...
 - Positive & Negative tonalities, with -20 um in thickness.
 - PR Patterning with MA6B mask-wafer aligner. Hard glass mask needed
 - Front to back alignment/patterning.
 - 1-um line width resolution.
 - PR patterning with Smart Photo UV (SPUV) LED exposure light source
 - Maskless printing with positive or negative tonality
 - It prints out overnight layout design directly onto a PR-coated wafer.
 - Fast R-D prototype designs with 2 -> 5 um linewidth resolution



MA6 Sample:
CD=5-um

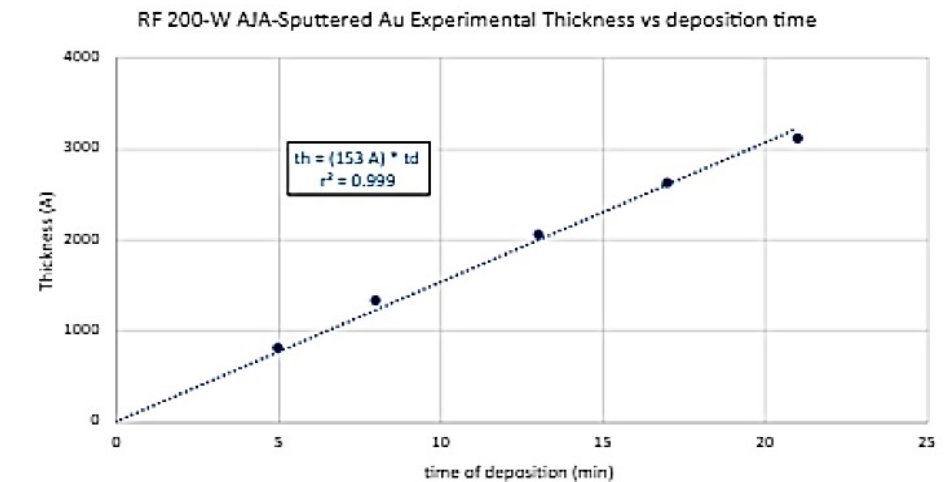
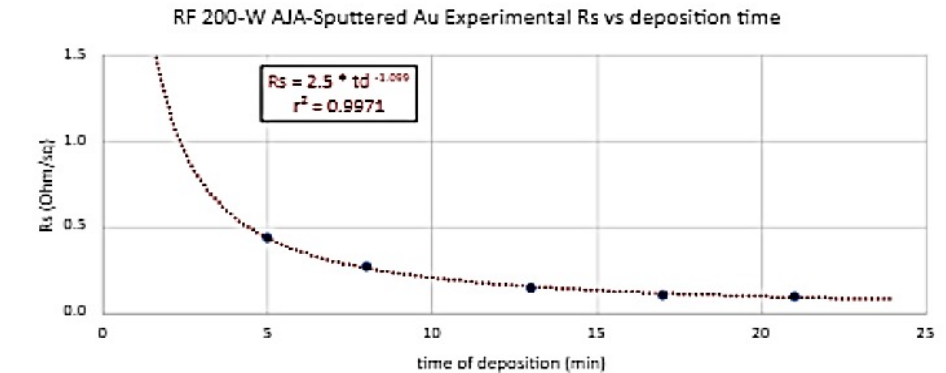


SPUV Sample:
CD=5-um

SEMICONDUCTOR PROCESSES AT MTTC

- Equipment and wafer processing characterization
 - Sputter metallization of common metals and dielectrics. Manual and Automatic deposition mode.
 - Metals: Al, Au, Cr, NiCr, Ni, Ti, TiW, Cu, Mo, W, Pt... Etc
 - Dielectrics: SiO_x, AlN, TiN, AlO_x, SiN, Poly-Si, PZT.. Etc.

Sputtered Au film characterization							11/9/2023
Equipment:		AJA Sputtering system at MTTC					
Target material:		3" Au	100%	99.99%			
		Mfgd by	AJA Int	HER8466	td (min)		
Deposition Conditions:		Ar:	20 sccm		6		
AJA-SputteringSystem/MTTC		Rotation:	16 rpm		8		
		Target-wafer separation	~ 12"		13		
		RF Pwr:	200 W		17		
		Ramp	40-60 sec		21		
Wafer type:		SiO ₂ /Si	Size: 4"		30		
		PR patterned	No	PR dots on wafer			
Experimental data							
td (min)	Rs (Ω/sq)	Rs*td (Ω-min)	th (Å)	dr (Å/min)	ρ (Ω-cm)	Pb (Torr) at td	
5	0.433	2.17	800	160.0	2.70E-06	5.00E-07	
8	0.270	2.16	1321	165.1	3.56E-06	5.00E-07	
13	0.147	1.91	2046	157.4	3.00E-06	5.00E-07	
17	0.106	1.80	2614	153.7	2.77E-06	5.00E-07	
21	0.096	2.02	3112	148.2	3.00E-06	5.00E-07	
Avg		2.01		156.9	3.01E-06		
Stdev		0.2		6.4	0.00000		

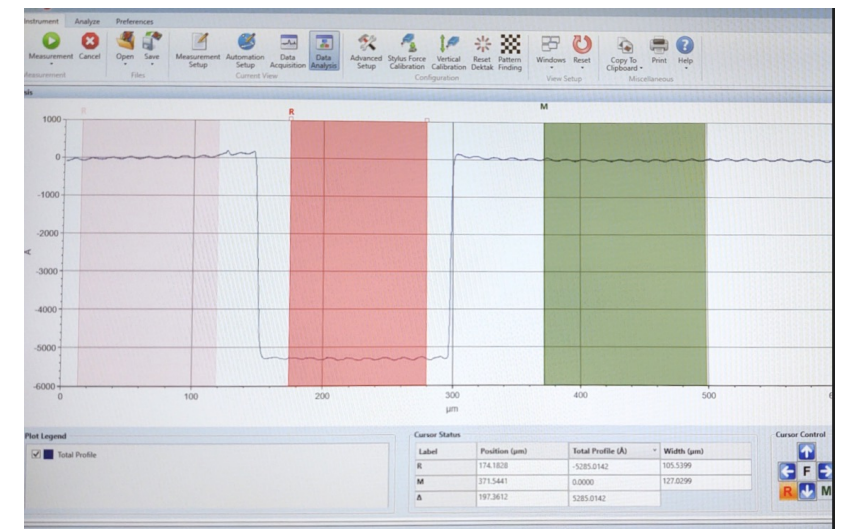
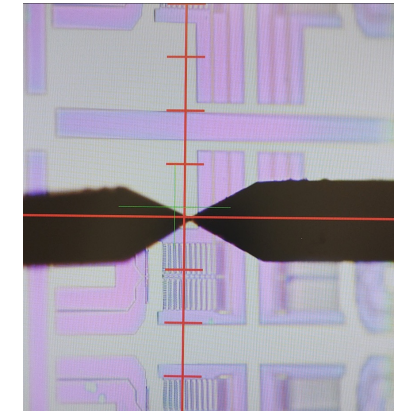


SEMICONDUCTOR PROCESSES AT MTTC

■ Metrology Equipment

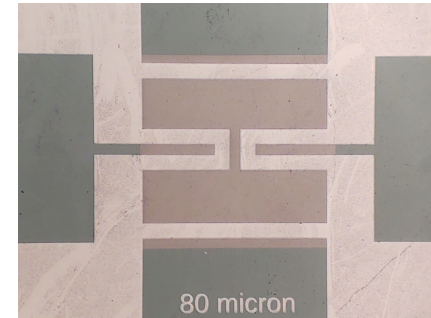
- Optical microscopes, from 50X to 1000X magnification
- Stereo zoom microscopes, 5X to 40X magnification
- SEM analysis for cross section and elements inspection
- 4-Point Probe for Resistivity measurements
- Dektak for step thickness and roughness measurements

Dektak:
Scanning stylus &
Step profile

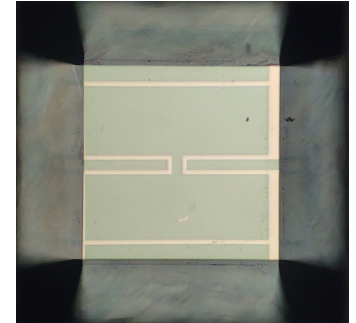


SEMICONDUCTOR PROCESSES AT MTTC

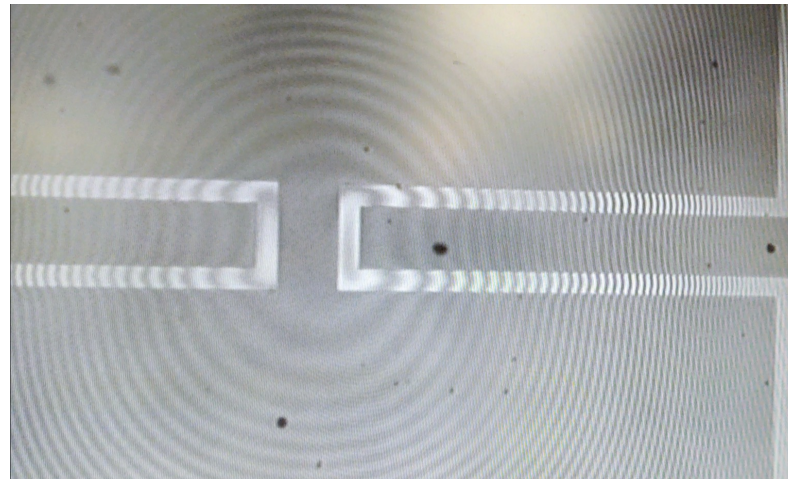
- Testing Equipment
 - Wafer Probing Stations
 - For Optical applications, such as Pressure Sensors of the Wheatstone Bridge type
 - For Electrical applications, such as Wafer die testing



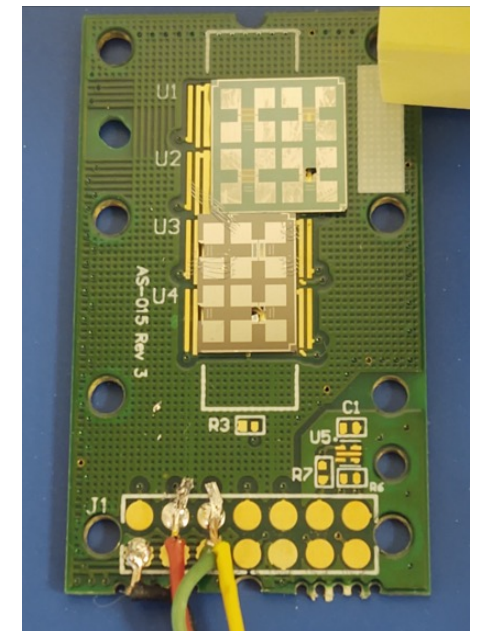
Pressure Sensor Die
Front and Back view



Wheatstone Bridge
under deflection forces

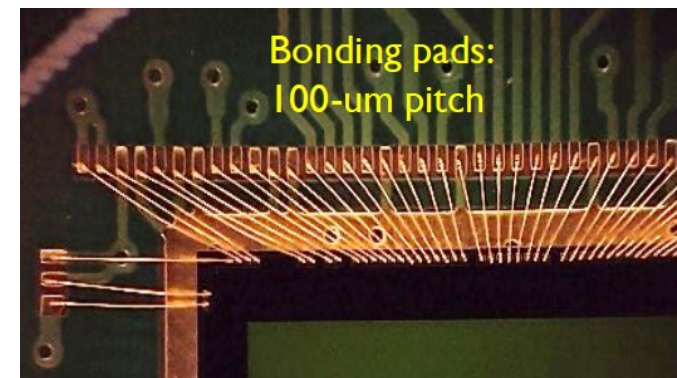
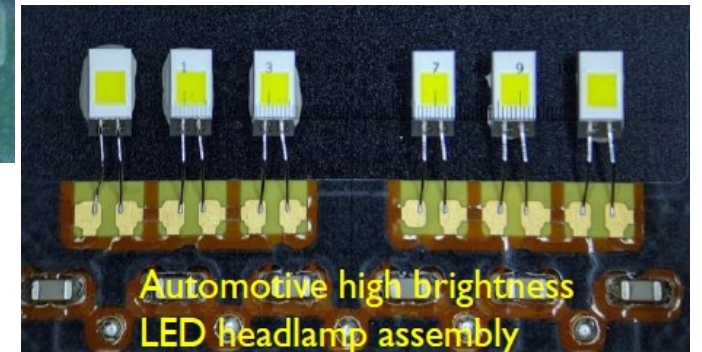
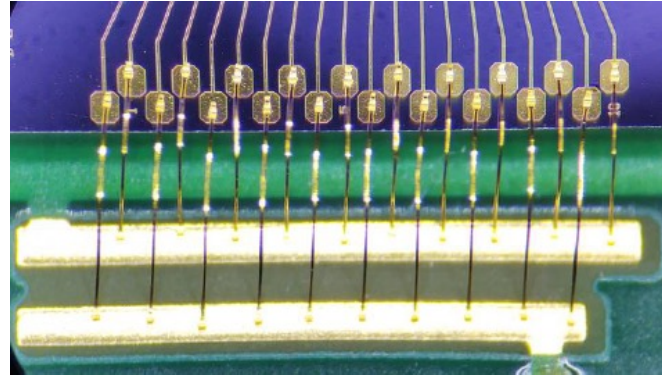


Wheatstone Bridge
Wire-bonded to PCB for
portable electrical
detection of pressure changes



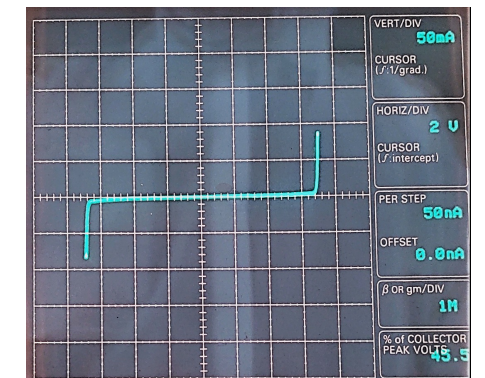
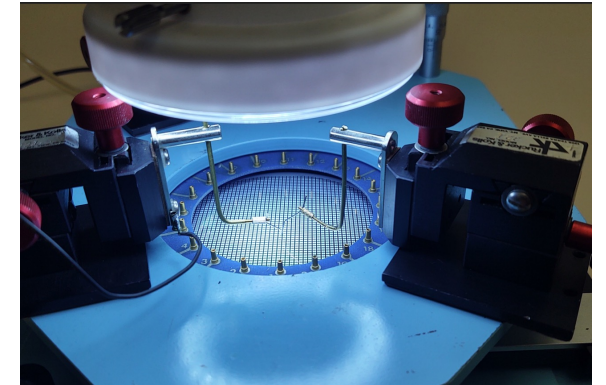
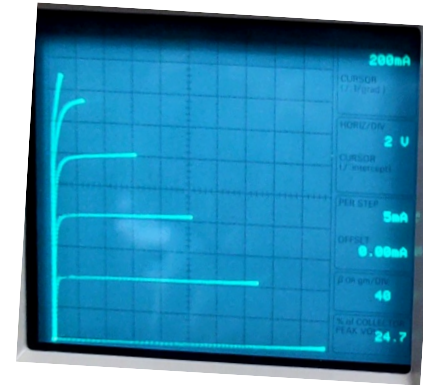
ASSEMBLY LAB AT MTTC

- Equipment and capabilities
 - Die Singulation
 - Wafer-tape-frame preparation
 - Dicing saw for up to 6" substrates
 - Die pick-n-place and die-epoxy attachment
 - Wire bonding
 - Aluminum, Gold, Copper
 - Fine bonding wire: 17-25 um in diameter
 - Heavy bonding wire: 75-125 um in diameter
 - Ribbon bonding: size determined by HF application



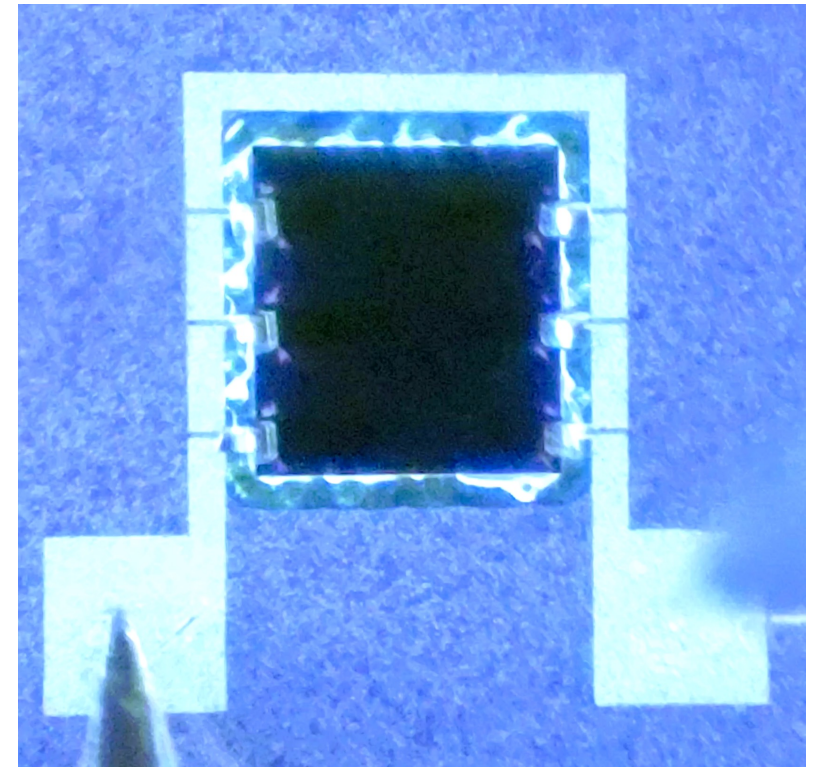
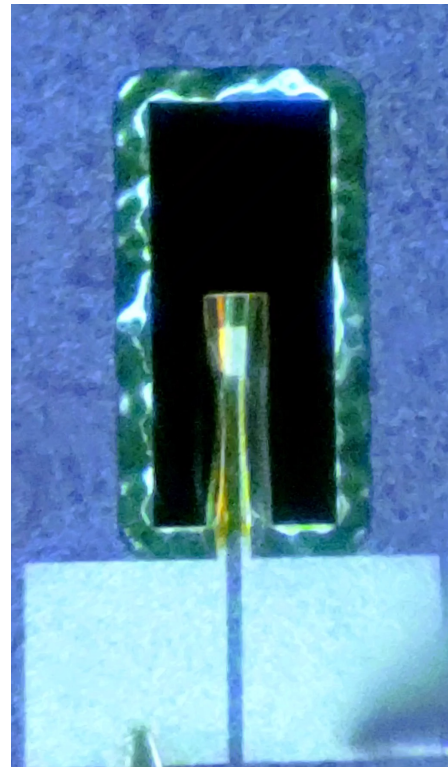
ASSEMBLY LAB AT MTTC

- Equipment capabilities
 - I-V Curve Tracer characterization of discrete IC, at wafer or package level
 - Electrical testing of discrete IC at bench level as required by application
 - Semiconductor parameter extraction from I-V curves
 - Experimental results compared against design parameters (of most importance for students to learn)



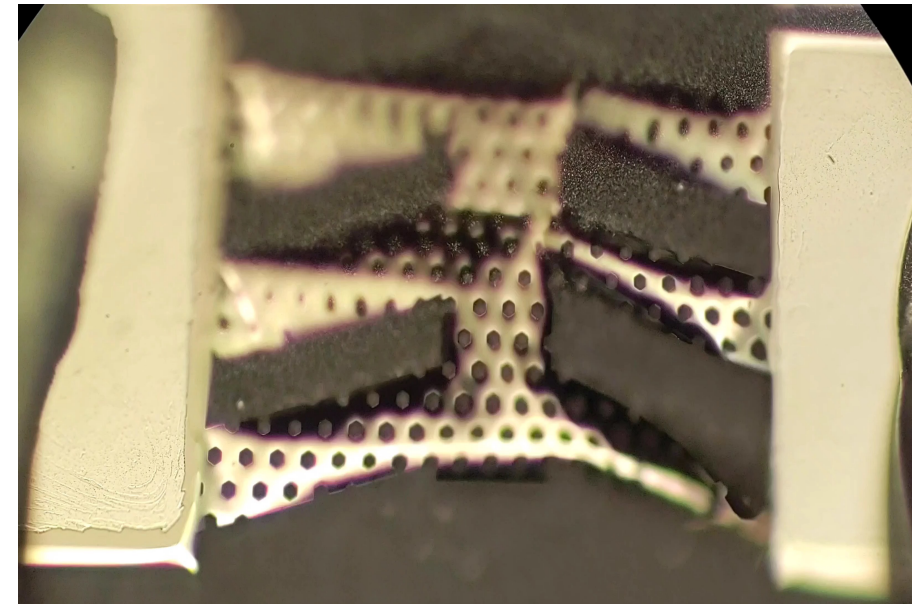
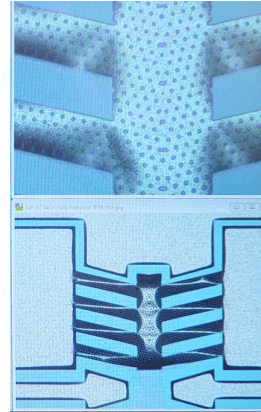
ASSEMBLY EXAMPLES

- Cantilevers
 - Released at wafer level
 - Before dicing only
 - Wet or Dry etching of sacrificial layers
 - Bulk Si or thin Si films can be used



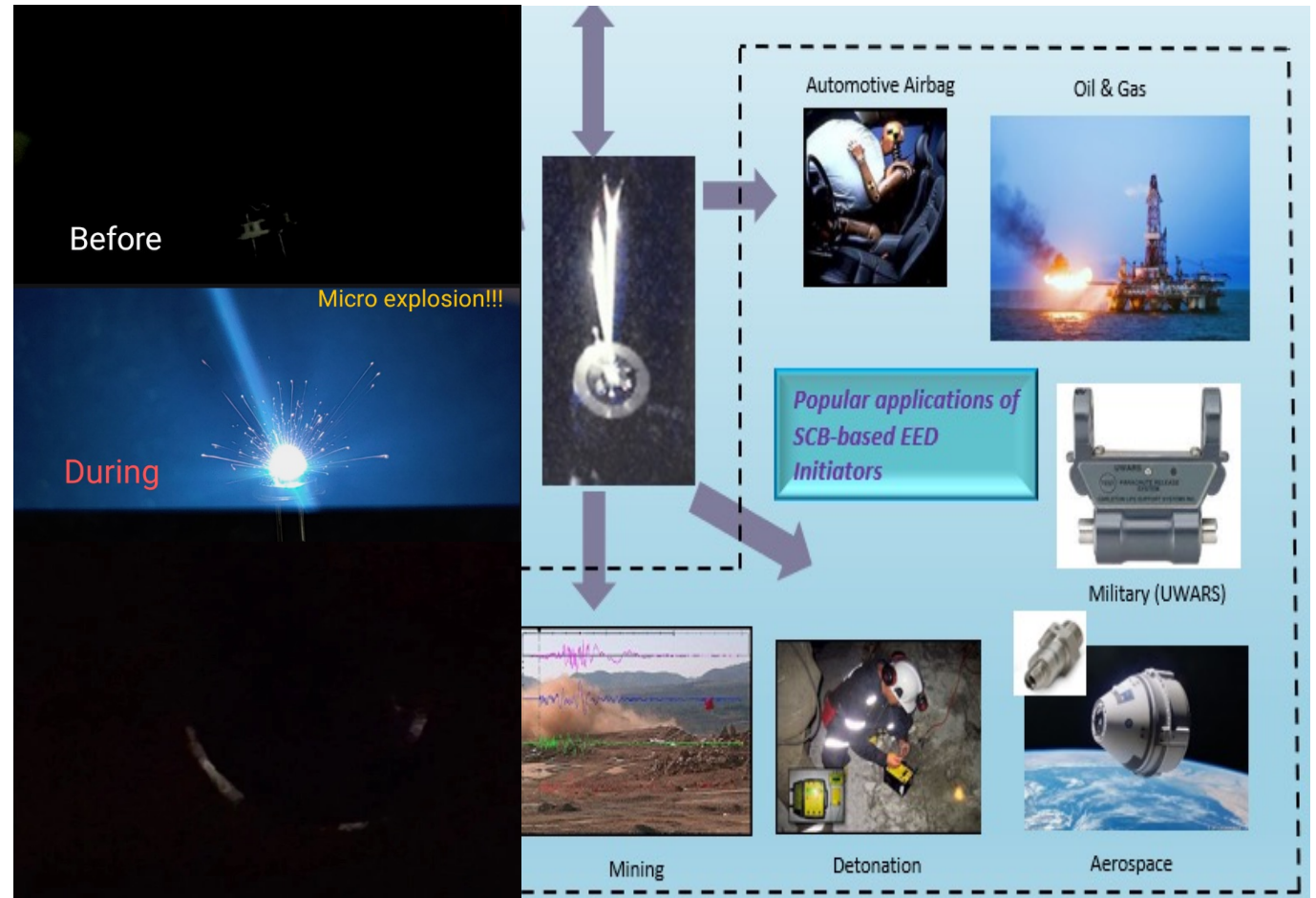
ASSEMBLY EXAMPLES

- Thin Film Actuators
 - Released at package level
 - After saw dicing
 - After wire bonding
 - Dry etched with XeF₂ chemistry



25+ MANUFACTURING EXPERTISE IN INDUSTRY

- Bringing businesses to MTTC
 - SCB Initiators qualified since year 2000 for:
 - Aerospace (ongoing activity)
 - Oil & Gas (ongoing production)
 - LED-PCB Assembly for automotive headlamps (sporadic activity at prototype level)
 - Batch wafer processing for industry-related SCB-products with capacity for 100K chips/month using 4" Si wafers



CONTACT US FOR MORE SPECIFIC INFORMATION

BRING US YOUR APPLICATIONS – WE CAN MAKE IT HAPPEN!

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