Fraunhofer
IPMS

Process Catalogue & Equipment

The competencies of the CNT division are focused on Next Generation Computing, devices for the Internet of Things and screening of processes and materials for 300 mm semiconductor manufacturing. More than 100 process and analytical tools for mainly 300 mm wafers are available. Due to a 4000 m² clean room as well as labs for analytics and electrical characterization compliant with state of the art industry standards, developments and new processes can be quickly integrated into the production lines of our partners.

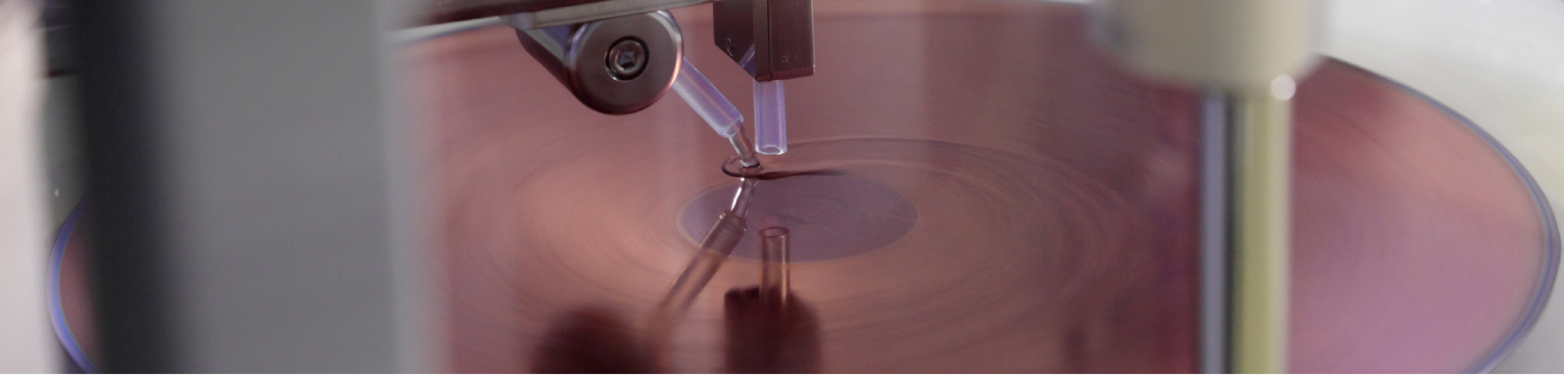
Etch	**TEL Tactras**	**AMAT Centura**			**AMAT Centura**			
chamber	Vigus LK3 HC	Enabler	Axiom	AdvantEdge G3	Enabler	AdvantEdge G5	AdvantEdge G5	Mariana
details	ALE, RF pulsing	large variability in gases		large variability in gases	large variability in gases	high T 250°C, RF pulsing		narrow gap CCP
materials	dielectrics (low-k, ULK, oxides, nitrides)	dielectrics (low-k, oxides, nitrides), ash	ash	metals (TiN, Ti, Al, AlSiCu, W), high-k (HfO_x, ZrO_x)	dielectrics (high AR oxides, nitrides), ash	high-k and gate stack (HfO_x, ZrO_x, AlO_x, TiN)	fine pitch Si etch	Si deep trench
contamination class	BEOL	BEOL			FEOL			

Clean Wet Etch	AMAT/Semitool Raider				Screen SU-3200			Screen FC-3000		
chamber	water/acid	solvent	UV-cure	coating	BEOL Spray	FEOL Spray	Bevel	recirculated bath	PoU bath	Marangoni Dry
details	spray, center dispense, backside, (megas-onic) bath		up to 1000°C	dispense	10–80 °C, front & back side	10–80 °C, front & back side	bevel and backside clean	recirculated up to 120°C, megasonic	point of use up to 65°C, megasonic	incl. HF last
materials	(d)HF, (hot) DI, custom water/acid chemicals	DI, custom solvents		custom chemicals	(u)dHF, SC1, CO2W, (h) DIW, 2x custom, solvent	(u)dHF, SC1, SC2, SPM, (h) DIW, DI-O_3, Solvent	dHF, (h) DIW, SC1, Solvent	SPM, SC1	SC1, (d)HF, HCL	IPA
contamination class	BEOL				BEOL / FEOL			FEOL		

CVD	AMAT Producer			AMAT Endura	ASM XP8-Dragon		ASM A412
chamber	Black Diamond	BLOk / Precision APF	Nanocure 3 UV-Cure	Volta	TEOS	Silan	LPCVD reactor
details	PECVD, twin chamber 300°C–550°C	PECVD, twin chamber 300°C–550°C	twin chamber	MOCVD (CCTBA, CoCo), in-vacuo XPS, IR lamp anneal	PECVD, twin chamber	PECVD, twin chamber	50 wafer batch
materials	low-k, ULK, SiCOH, OMCTS, BDx	SiCN, SiN, SiO_2, carbon HM		Co	SiO_2	SiN, SiO_2	polySi, SiGe poly & Epi, a-Si, insitu B and P doping
contamination class	BEOL			BEOL	BEOL / FEOL		FEOL

ALD	ASM XP4		Jusung Eureka		ASM A412	AMAT Endura
chamber	EmerALD	Pulsar	ALD	ALD	LPCVD reactor	ALD
details	PEALD 50°C–350°C	thermal ALD 200°C–350°C	thermal ALD 200–400°C	thermal ALD 200–400°C	ALD/CVD	th. ALD 200–350°C
materials	SiO	HfO, ZrO, AlO	HfO, AlO, other	ZrO, AlO, other	TiN	Ta_3N_5 (PDMAT)
contamination class	FEOL		FEOL		FEOL	BEOL

Anneal	TEL Formula	Mattson Helios XP	
specifics	Cu Anneal 100–400°C	RTP 250–1200°C	
gases, application	N_2, H_2, Ar, VAC	O_2, Ar, H_2, N_2O, N_2	Silicidation, RTO, RTA
contamination class	BEOL	FEOL	

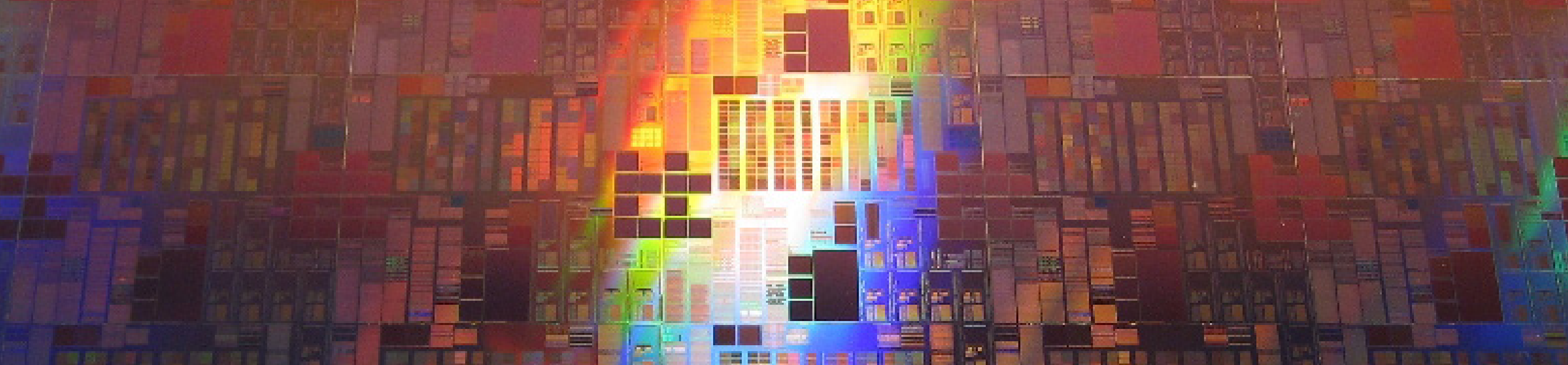


PVD	AMAT Endura		AMAT Endura			
chamber	ACCESS II	EnCoRe II	Clover	Clover MgO	Clover	Clover
details	PVD: ultra long range sputter, SIP; 3 EM, biased collimator; Cu-Backetch option with high rf bias up to 1kW, in-vacuo XPS	PVD: SIP; Ar-Backetch option with high rf bias >1kW, in-vacuo XPS	PVD: DC, pDC & Rf; up to 450°C; Cosputter	PVD: RF; superb uniformity, sub-nm layers {for all Clover}	PVD: DC up to 5 targets	PVD: DC up to 5 targets
materials	Cu	Ta, TaN, Ti, TiN	HfOx, Ti, TiN, Si	upon request	upon request	upon request
contamination class	BEOL		FEOL	MRAM		

CMP	AMAT Reflexion LK	
auxillary systems	flexible liquid supply system (4x platen feed; 2x cleaner feed), slurry analysis (Malvern Zetasizer; SITA DynTester+)	
process	Metalization/Damascene	Oxide/STI
endpoint systems	Eddy-Current, optical (fixed wavelength), motor torque	optical (white light spectrometer), motor torque
materials	Cu, Co, Ta/TaN, TEOS, ULK	SiO_2 (TEOS/HARP/HDP), Si_3N_4, SiGe
contamination class	BEOL / FEOL	

Litho	Vistec SB3050 (shaped beam)	TEL Track (ACT12)	Brewer Science
substrates	150/200/300 mm substrates	full automatic 300 mm wafer coating / developing	stand alone coater & developer, 100, 200 mm substrates
details, specifications	CD dense line/vias: <40 nm; iso line/vias: <20 nm; overlay: <20 nm	ca. 80 nm nCAR, ca. 60 nm/ 120 nm/ 480 nm pCAR, 1 µm iLine resist	
contamination class	BEOL / FEOL	BEOL / FEOL	BEOL / FEOL

ECD	AMAT / Semitool Raider ECD		Lam Sabre Extreme		
chambers & processes	Cu Damascene, Co Damascene	Post Clean, Bevel Etch, Anneal	Cu Damascene, Cu TSV	Cu RDL, Pillar, Bump Pre Wet	Post Clean, Bevel Etch, Anneal
contamination class	BEOL		BEOL / BE (UC)		



METROLOGY	
tool name & supplier	**details**
KLA SP2	Surface scan particle measurement
KLA SP3	
KLA RS100	4-point probe resistance measurement
Nextin AEGIS	patterned defect inspection, bright and darkfield
AMAT Verity 4i	CD-SEM
Veeco 3D-AFM	In line AFM with trench capability and charge compensation
KLA Spectra FX100	film thickness and uniformity, wafer bow
XPS from Nova and Thermo Fisher	With Al-Anode → Sputter depth and angle resolved profiling
AMAT CD-SEM	CD-SEM measurements
AMAT G3i Review SEM	EDX and FIB capability and tilted stage
KLA HRP340	Several needles and 3d option
XRR/XRD from Bede (Bruker)	Thickness measurement, Material properties (roughness, density, cryst. structure, texture)
KLA Optical Microscope	optical inspection

ANALYTICS	
tool name & supplier	**details**
ToF-SIMS.5 from iontof	Cs and O gun
AFM Cypher from Oxford instruments	Additional piezo response mode
XPS Quantes from Phi	with Al and additional Cr (HAXPES), Sample heating and cooling, imaging mode
XRR/XRD D8 Discover from Bruker	thickness, material properties, HighTemperature option
SEM ApreoS from ThermoFisher, SEM S5000 from Hitachi	equipped with electron diffraction for transmission (TKD) and backscattering (EBSD) and EDX
FIB/SEM Strata 400 from FEI	Dual beam, GIS: C and Pt, EDX
TEM Tecnai F20 from FEI	200 kV, energy filter (EFTEM, EELS) and EDX
InVia µRaman Microscope from Renishaw	composition analysis, stress measurement
FTIR 640-IR from Varian	elemental composition, ATR option
TXRF S2 from Picofox	elemental analysis

ELECTRICAL CHARACTERIZATION	
equipment	**details**
wafer probing stations	
TEL Automatic wafer probers 200/300 mm	lab and inline
FormFactor/Süss Microtec Semiautomatic wafer probers	couponlevel upto 300 mm, -60°C … 300°C, nitrogen purging possible
Imina MiBot system	SEM in-situ probing solution, nano-probing
Cryogenic probestation	<2K, only couponlevel
test equipment	
Keysight Semiconductor Parameter Analyzers	CV/IV device char., NVM char., device reliability
Keysight Vector Network Analyzer	RF IV, loadpull, parameter measurement up to 110 GHz
ProPlus Flicker-Noise characterization system	flicker noise, 1/f noise, RTN char.
NI PXIe Systems optimized for Mixed-Signal Test	NVM array characterization
Aixacct TF3000 FE-Polarization Analyzers	ferroelectric polarization and switching studies
High temperature storage cabinets	nitrogen purged
Infratec Lock-In Thermography camera	failure localization and thermal characterization
Hprobe MRAM test system	MTJ device char., RH measurments

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