Photonics: Silicon-Photonics, III-V, Optics

2018-2022 Microsystems Technology Roadmap, June 2018

Canada's National Design Network

Photonics Technologies	2018	2019	2020	2021	2022
Silicon Semiconductor SOI	✯SOI on 300mm wafers		•Ge waveguides, Si cladding, 8-10μm		
			✯TSV in Si-P MPW		✯Epi-based III-V gain blocks in SOI PDK
	•SOI optimized for long wavelength		•BIST, ATPG for photonics		
		✯Sub-wavelength structures			
	✓Si-P rapid prototyping with e-beam		•Strained Ge for direct gap applications	•Si-P in "zero change" CMOS	
	• Si3N4 for low loss and/or shorter wavelengths				
Si3N4/Si/SiO2	✯Hybrid SOI and Si3N4 platform				
Compound Semiconductor	✯III-V integration platform				
Hybrid Integration & Packaging					
	✓III-V epi on Si		•Transfer printing of III-V to Si-P		
		☆ Sub-wavelength structures			
III-V + silicon photonics	✯Device scale III-V bonded to Si			•Nanowire or templated heteroepitaxy in Si-P PDK	
		•Wafer scale III-V bonded to Si			
			✯Optical interposer with integrated source		•Intra-chip optical interconnect
		✯Glass interposer			
Interconnect	•Photonic wirebonds	✯Interposer with optical I/O			
				✯Optical interconnect in organic substrate (PCB)	
	✓Sub dB passively-aligned coupling in Si-P PDK				
CAD and Modeling			✯Integrated schematic-driven Si-P and uE PDK		
	✓Integrated Si-P CAD tools (schematic/simulation/layout/ verification) with IP libraries	☆ Monolithic photonic/microelectronic PDK			
		•Photonic device package PDK			
			✓Integrated package / chip PDK		
				•Package/chip PDK with thermo-mechanical modeling	
		✯Si-P PIC LVS with thermo-mechanical modeling			
	✓ Schematic-driven Si-Photonics design flow		☆ Photonics & Microelectronics co-design flow		
	✓Experimentally verified compact models in Si-P				
	2018	**2019**	**2020**	**2021**	**2022**

The Microsystems Technology Roadmap has 5 segments:

Microelectronics/MEMS/NEMS, Photonics, Embedded Systems, Packaging and Multi-scale Integration, and Nanofabrication Labs.

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✓	Key technology feature of a planned Product or Service; Development activities are underway and/or supply chain is available.
☆	CMC is seeking collaborators, suppliers to deliver capability.
•	Anticipated technology feature based on roadmap sources.

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