Integrated Photonics Chapter

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Chairman of Third Millennium Test Solutions

Dr. Bottoms received his Ph.D. from Tulane University and began his post graduate career in academia as a member of the EE faculty at Princeton University. He has worked in venture capital and as CEO of several companies both public and private.

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Integrated Photonics TWG

HETEROGENEOUS INTEGRATION ROADMAP

The scope of the Chapter is focused on:

Identification of electronic-photonic integration challenges with sufficient lead time to stimulate pre-competitive collaboration to accelerate development of solutions before these challenges delay the pace of progress.

This scope covers integration of electronic, photonic and plasmonic components into packaging solutions to decrease size, weight, cost, power and latency while increasing performance and physical density of bandwidth.

Scope Includes Six Special Topics

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These Special Topic Areas are:

- Photonic components such as sensors, photon sources and modulators
- Integrating these components and subsystems into systems
- Data centers, high performance computing and the global network
- Photonics in the automotive industry
- Photonics for IoT
- Supply chain requirements for photonic/electronic integration

Photonic/Electronic Integration Is Complex

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Diverse components included in Photonic/Electronic 3D-SiPs

- Monolithic photonic ICs (incorporating photonics, electronics and plasmonics)
- Discrete optical components not integrated in Silicon-photonic integrated circuits

Different materials, operating temperature requirements, mechanical strength, shielded compartments inside the package, input/output connections and operating voltage for many of the components

- Optical interconnects to and from the outside world
- Electrical interconnects to and from the outside world
- Passive components (including integrated passive devices)
- New devices and materials that be introduced over the life of this Roadmap.

Limiting Factors for Future Integrated Photonics Systems

Challenges

- Co-Design and Co-simulation tools
- Prototypes at affordable cost and adequate yield
- Temperature stable Photonic components (laser, modulator, etc.)
- Reduced size of optical components (closer to electronics)
- Move photonics closer to the transistors at low cost

Potential Solutions

- Design verification in CAD
- Multi-project wafers now available- more coming
- Plasmonics, quantum dot lasers, plasmonic lasers
- New devices for laser, modulator, O-to-E and E-to-O, etc.
- New solutions on system circuit board, on package and maybe on chip; low loss connectors and waveguides needed

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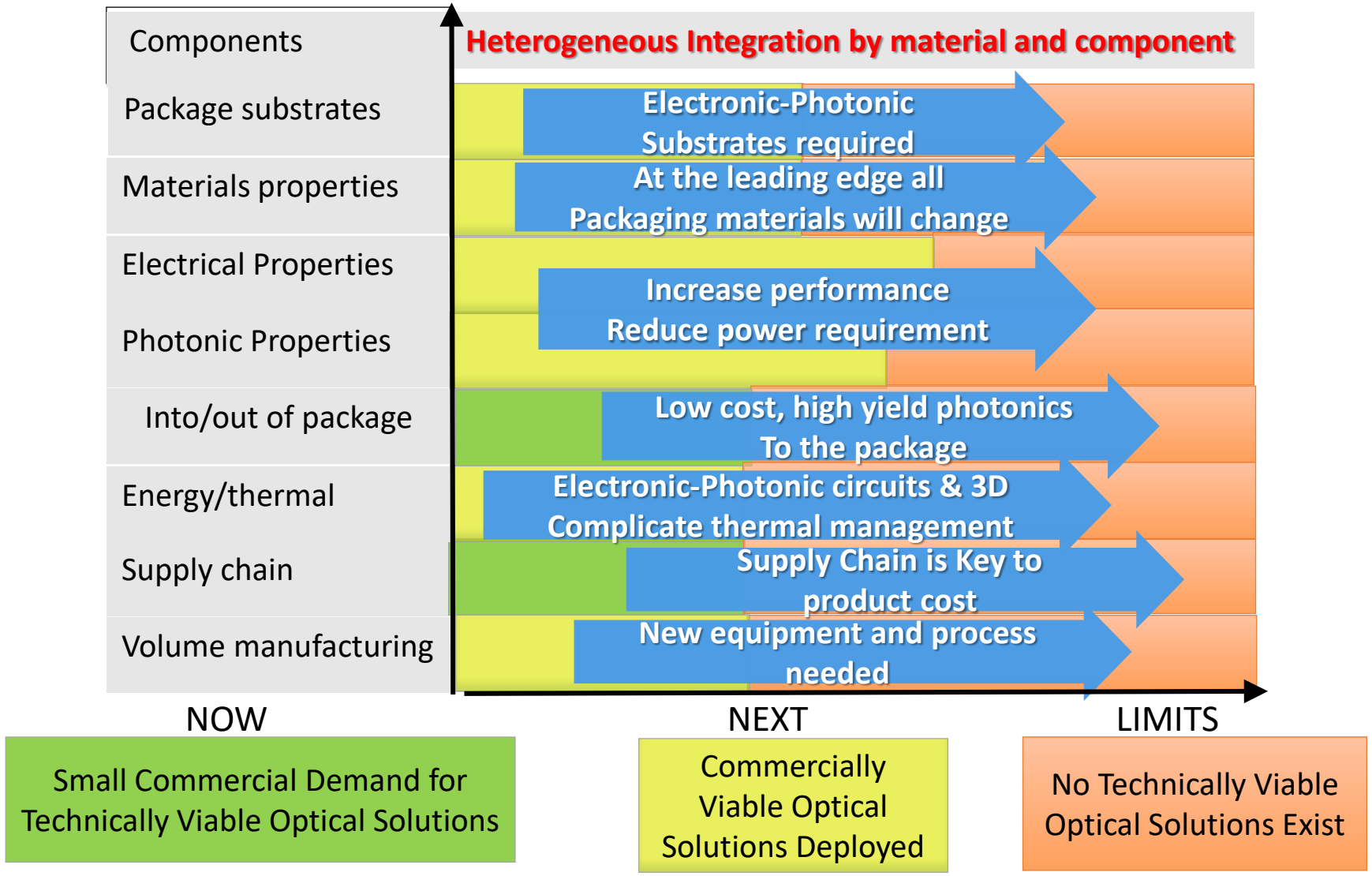
Electronic-Photonic System Integration Roadmap



The Scope Addresses Specific Applications

There are a large number of devices involving photons which share the common requirement of providing a photon path either into or out of a system or both. They include:

- Light emitting diodes (LEDs)
- Laser diodes
- Plasmonic photon emitters
- Photonic Integrated circuits (PICs)
- MEMS optical switching devices
- Camera modules
- Optical modulators
- Active optical cables
- E to O and O to E converters
- Optical sensors (photo diodes and other types)
- WDM multiplexers and de-multiplexers

NO COMMON PLATFORM YET

Many have unique thermal, electrical, mechanical characteristics that will require specialized materials and system integration (packaging) processes and equipment

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Plans For Integrated Photonics Chapter 2020

HETEROGENEOUS INTEGRATION ROADMAP

- **Expanded coverage of new photonic components. Photon sources, Sensors, Modulators, etc.**
- **Expanded coverage of plasmonics**
- **Coverage of the potential for optical logic**
- **Update and expand tables reflecting introduction of complex 3D SiPH ICs and improvements in performance, power, size and cost**
- **Recruit more participants from Asia**

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Thank You For Your Attention

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