

Next Generation Modulators

Myths

5th September 2025

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Once a Myth, always a Myth ?

- There are (maybe) several myths regarding the materials and technologies that will be powering the transmit side of optical connections between and within the datacenters to be built in the coming 5 years.
- The 8 myths presented here can be considered as items existing more towards the mythical end of the spectrum of truth and probability (as of today).
- But some of them may well **shift** towards the opposite end of the spectrum, that is, items which are very likely to be true and become reality.

Myth #1: New Materials

No new material system will be needed for next generation modulators in coherent or IMDD plugs and/or CPO.

Supporting

- Reliability of the optical networks is too important to take the chance.
- The industry has always found a way to extract better performance from InP, LN, and SiPh modulator technologies. This will continue.

Against

- SiPh has reached the end of its evolution when it comes to speed increases.

Myth #2: BTO vs. TFLN

If BTO is proven viable, then TFLN will be made obsolete.

Supporting

- BTO, when proven out, will be a smaller, (nearly as fast) and overall, a less expensive choice.

Against

- Familiarity with LN provides momentum for its continued use in the “best fit” applications.
- BTO Supply Chains not broad enough yet.

Myth #3: BTO Supply Chain

BTO will never be adopted without multiple, independent suppliers.

Supporting

- There is no example today of a single-sourced optoelectronic material system / technology.
- Constrained supply chains (e.g., geo-political) suggests limited capacity for additional supply chain risks.

Against

- An application which benefits strongly enough from BTO's capabilities will manage the short-term risks.
- Several precedents for single suppliers early in the adoption of a new optoelectronic technology.

Myth #4: Reliability of Polymers

E/O Polymer materials are sufficiently reliable for datacenter applications.

Supporting

- Organic materials have been proven in consumer product categories such as displays.

Against

- Consumer & Commercial displays do not have as stringent of reliability requirements as xPU interconnects.
- If it were possible to qualify an organic material for communications applications, it would have happened by now.

Myth #5: BTO Readiness

BTO is ready today for wide manufacturing and adoption for datacenter applications.

Supporting

- Not much supporting evidence.....yet.

Against

- Qualification of the first two devices employing a BTO modulator will be qualified within a year.
- Manufacturing readiness programs are well underway, also with a mid-2026 milestone.

Myth #6: Poling of BTO & TFLN

The poling requirements of BTO and TFLN are similar and straightforward to implement.

Supporting

- Both materials require poling to achieve performance.

Against

- TFLN poling can be accomplished at the time of the material manufacture.
- BTO requires poling during operation, continuously. This is a high bias voltage (30-40V); minimal current draw.

Myth #7: Figures of Merit

pJ per bit electrical power consumption is the most important Figure of Merit (FOM) for new xPU interconnect systems.

Supporting

- Power consumption is a “Top-3” challenge, broadly speaking, where Datacenter builds are concerned.
- Unit volumes are increasing such that every mW saved matters.

Against

- Increasingly, bandwidth density – shoreline and “3D” will take over as the top FOM.
- A hybrid FOM incorporating power consumption + bandwidth density should be used for any given application.

Myth #8: Fabless Business Models

A fabless business model for a startup planning to introduce a new material system is the optimum strategy.

Supporting

- Going fabless reduces capex, headcount and other expenditures.
- Leaves the fabrication expertise to the larger, more experienced firms.

Against

- "Tuning" **new** processes with a **new** material requires daily interactions as both are brought to maturity. New processes are often needed even **without** a new material (at the leading edge).
- Even if outsourcing all fab is successful, it is hard, early on, for the startup to capture the full market value of its designs.

Thank You