

BRINGING HIGH-SPEED OPTICAL NETWORKS TOGETHER

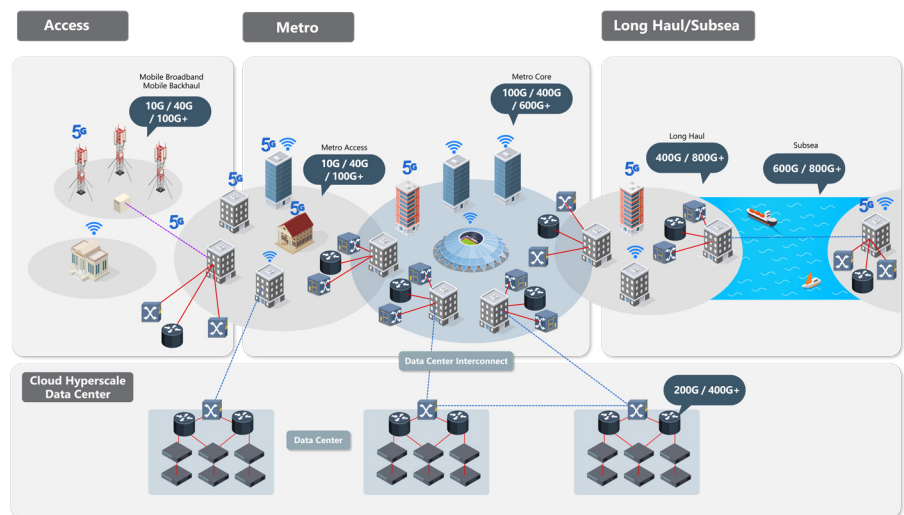
Adhesive Technologies are Critical for Reliable Performance

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Optical transceivers, switches and components are the engines of expansive data networks for metro, long haul, sub-sea and data center interconnect (DCI). Cost-effective and high-speed capable, optical devices have transformed in recent years, becoming smaller in size, using less power while increasing data throughput.

Within data center and network devices like ROADMs, optical transceivers, and optical and wavelength selective switches (WSS), adhesive materials have a significant influence on durability and long-term performance. Device constructions incorporate delicate lenses, laser diodes and fiber, and their stability and precise alignment are integral to operation. Because of this, adhesives play a large role in optics performance.

Among the most demanding applications are optical transceiver sub-assemblies (TOSA/ROSA) and the wavelength selective switch within ROADM/optical switches. All optical components and fibers require ultra accurate alignment and, once set in place, must be secured with materials that will not shrink or move over time. If they shift, light transmittance and, therefore, the optical signal may degrade and/or fail. Today, as data processing expectations have escalated, demands on performance have only become more intense.

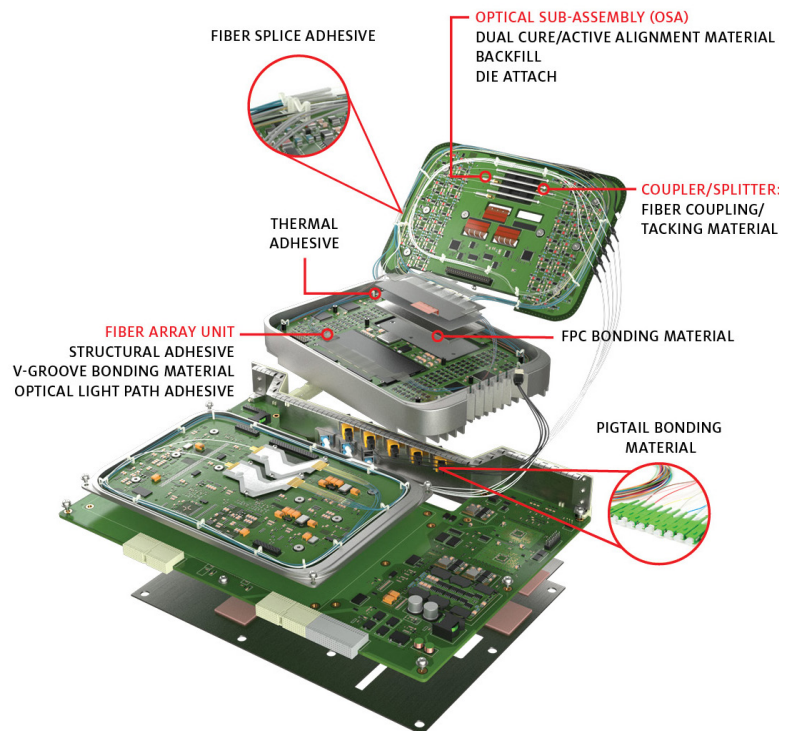


Tim Munks, Senior Principal Analyst at Omdia, explains the challenge in relation to optical modules: *“Transceiver development has dramatically accelerated to keep pace with the exponential data processing demands, as is evidenced by the quick move from 100 GbE to 400 GbE to now 800 GbE modules,”* he says. *“Over the next four years, we expect the unit volume CAGR for 400 GbE to be greater than 200% and more than 300% for 800 GbE. Optical communication efficiency is the key to meeting the expectations for cloud, video, gaming, work and learn from home applications – and it is only getting more intense. Transceiver reliability, signal integrity and lower loss optics are critical.”*

In high-capacity transceivers, as well as in ROADM assemblies, high-integrity dual cure active alignment adhesives are used to position the optical lenses. Following a first stage UV partial cure, lenses are aligned and then undergo final cure. Dimensional stability within the application is critical to meet the performance and signal integrity requirements of optical devices, so adhesive characteristics must deliver:

- **Positional integrity and dimensional stability to maximize optical signals.** This requires a material with:
 - Low coefficient of thermal expansion (CTE)
 - <1% volume shrinkage post-cure
 - Low moisture absorption
 - Ability to strongly adhere to multiple substrates
 - High thermal cycling stability (85°C/85% RH testing)
- **Processability and energy conservation.** A high UPH rate can be accelerated with a material that delivers fast first-phase UV cure that uses low wattage UV.

The ultimate goal is to minimize signal loss and doing so can be the difference in optical network efficiency. Tolerances of less than 5 µm for lens and component movement leave little room for variation, making adhesive capability one of the most important considerations when constructing optical devices. This holds true not only for active alignment materials, but also for optical light path adhesives that attach glass elements, including the fiber array unit (FAU), cable assemblies and applications within the ROADM. Low weight loss materials that limit any risk of optical contamination, provide a matched refractive index to maximize the speed of the light beam, and provide manufacturing flexibility with fast dispensing and curing help address the cost and performance requirements for manufacturers and network integrators. Ultimately, the more optical transmittance along the light path afforded through carefully formulated, high bond strength adhesives that do not introduce any interference, the more robust and fast the optical signal will be.



As transceiver and switch designs continue to evolve to manage the demands for faster signal speed, long-term reliability and lower cost, adhesive engineering will be a major contributor to achieving these objectives. For more information about Henkel's portfolio of die attach, structural, optical and active alignment adhesives, visit this [online resource](https://www.henkel-adhesives.com/us/en/industries/data-and-telecom-infrastructure/optical.html).

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