

# FIBER OPTICS

## Tech Pulse



PHOTONICS MEDIA

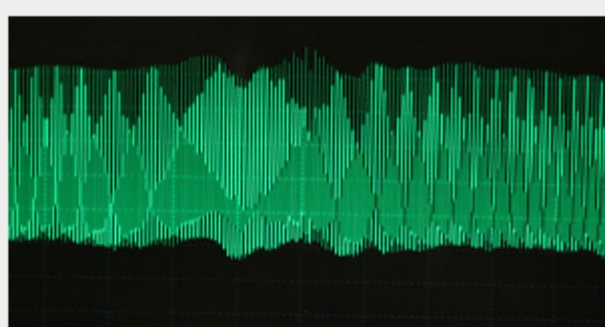
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Fiber Optics Tech Pulse is a special edition newsletter from Photonics Media and Nufern covering key developments in fiber optics technology.

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### Frequency Combs Reverse Crosstalk, Extend Range of Fiber Transmission

Frequency combs could eliminate the need for repeaters, which are necessary for maintaining signals over long distances in today's fiber optic networks. This presents a potential solution to a long-standing roadblock to increasing fiber transmission rates: Beyond a threshold power level, additional power irreparably distorts the information.



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PROMOTED CONTENT

Nufern

### Selecting the Optimal Er/Yb Doped Optical Fiber: Design Considerations and System Performances

Er/Yb fibers are well suited to achieve high performances in the 1.55  $\mu\text{m}$  wavelength range, allowing to reach a few Watts to Watt-level of output power. However, we demonstrated that these performances are directly tailored by the core composition and the structural design of the fiber. The key to success is to clearly identify the target output performances and to choose the most appropriate fiber design.

**Introduction:**  
The goal of this tutorial note is to provide the reader with the proper tools to understand the principles of light emission in Er/Yb fibers and related design considerations. This article should serve as a guide for the users to select the optimal Er/Yb fiber in order to achieve the highest output performances within their system requirements.

**General Er/Yb fiber amplifier architecture**  
Er/Yb double-clad (DC) fibers are used in laser or amplifier systems for power scaling and/or single-frequency applications. Depending on the system architecture and the targeted output power and efficiency, the choice of the fiber design is critical. To illustrate this statement, a typical Er/Yb fiber amplifier is schematically represented in Fig. 1. It starts with a seed light source emitting in the 1.55  $\mu\text{m}$  wavelength range with 100 mW or less available power. These are generally commercially available modules such as a laser diode or a narrow-linewidth distributed feedback (DFB), operating in continuous or pulsed regime, with or without polarization maintaining (PM) properties. The seed light is coupled in one or more fiber amplifier stages. Each amplifier is made using a DC Er/Yb fiber - one or multiple 900 nm pump modules via the use of multi-lap fiber combiners (set in co- or counter-propagation) and additional devices such as polarization optics and optical isolators.

**Fig. 1: Typical Er/Yb fiber amplifier architecture**

A light source typically emitting 100 mW of output power or less is amplified by one or more fiber amplifier modules made with Er/Yb fibers. For that scheme can be chosen depending on the target output power ( $P_{out}$ ) while the achievable amplification levels are indicated with green arrows.

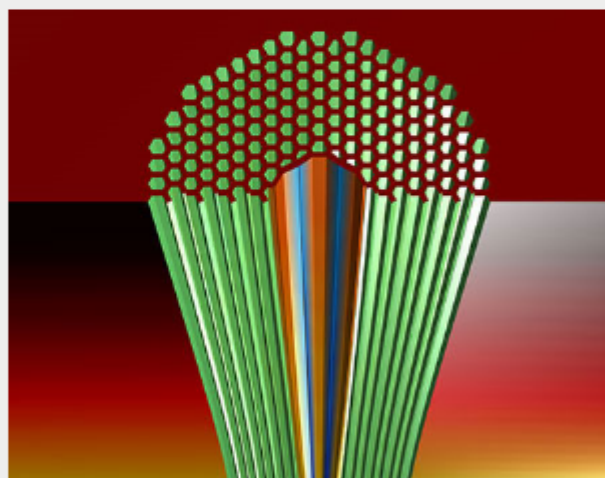
The number of amplifier modules depends on the target output power and -directly on the extensible fiber gain. In Fig. 1, two common cases are distinguished corresponding to target powers of (a) a few Watts or (b) a few tens of Watts. Achieving a few Watts output power requires an amplifier able to deliver 15 to 18 dB optical gain. It is common to associate these amplifiers with only one pump module delivering on the order of 10 Watts of power. In this case, the best Er/Yb fiber candidate must perform

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### Photonic Bandgap Fiber Reaches Telecom Scale

New fabrication tools have enabled the creation of an 11-km photonic bandgap fiber that previously could only be manufactured in lengths of hundreds of meters. Its reach, as well as its low loss and a broad transmission bandwidth, make photonic bandgap fiber a candidate for telecommunications applications.

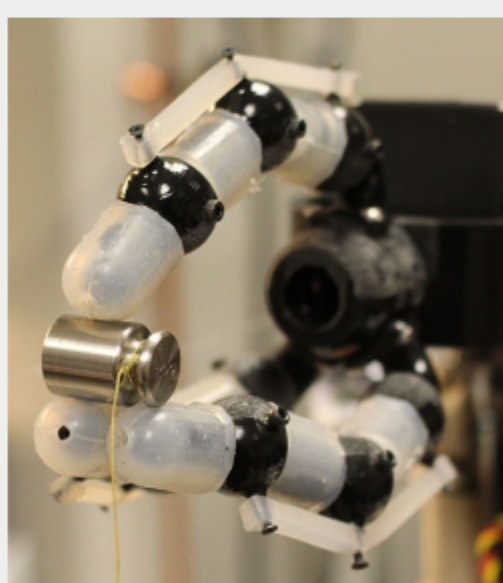


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### Fiber Sensors Improve Robot Touch Sensitivity

Fiber optic sensors could give robots the sensitivity needed to handle delicate objects and work safely alongside humans. A newly developed robotic hand features 14 embedded fiber Bragg grating sensors, allowing it to determine where its fingertips are in contact and to detect forces of less than a tenth of a newton. Meanwhile, a new stretchable optical sensing material could be used in a soft robotic skin to provide even more feedback.

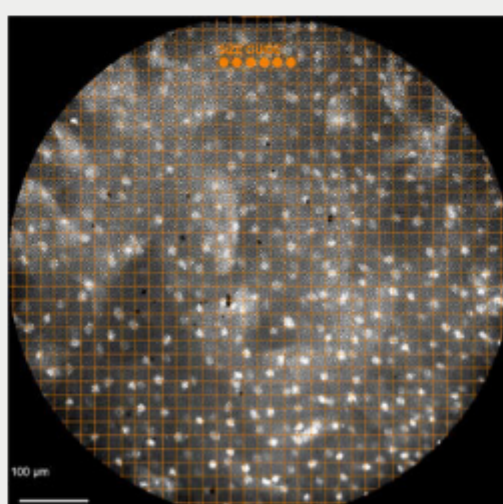


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### Fiber Microendoscope Could Reduce Unnecessary Biopsies

A low-cost, portable, battery-powered microendoscope could reduce the need for costly biopsies for many patients. That's the conclusion of researchers behind a clinical study involving 147 patients in the U.S. and China at high risk for esophageal squamous-cell neoplasia.



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### Fiber Industry Group Pushes SWDM for Data Centers

A new industry organization aims to help data centers minimize upgrade costs by exploiting new capabilities of older optical fibers. The SWDM Alliance will promote shortwave wavelength division multiplexing (SWDM) technology, which increases the capacity of multimode fiber already common in data centers.

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