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Hybrid Gain Flattening Filters in Optical Fiber Amplifiers

Hybrid GFFs save space, simplify system layouts, cost less than a two-filter setup, and offer unparalleled reliability. Meet the new standard in optical fiber amplifier components.

By Xiaolan Zeng and Michelle Denoain, Iridian Spectral Technologies

On Nov. 26, 1903, Clyde J. Coleman was issued a patent for an electric automobile starter. The 1912 Cadillac became the first car to replace the hand crank with an electric starter motor and, by 1920, electric starters were ubiquitous across all vehicle brands and models.

Much like vehicle hand cranks in their day, the use of a gain flattening filter (GFF) paired with a wavelength-division multiplexer (WDM) in optical fiber amplifiers – such as erbium-doped fiber amplifiers (EDFA) – has been accepted not because it is ideal, but because a superior solution had yet to be created. Until now.

This article explains what a Hybrid GFF is and how it works. It also details the advantages of using Iridian Spectral Technologies' Hybrid GFFs in lieu of a conventional two-filter setup in EDFA and other optical filter applications.

How GFFs and WDMs Serve Optical Fiber Amplifiers

EDFA modules are commonly used in fiber optic communication systems to recover the optical signal after it has been transmitted over a certain distance. Traditionally, electronic amplification was used for this task, transforming the optical signal to an electrical signal, amplifying that signal, and then transforming the updated electrical signal back to an optical one.

However, EDFA modules (passive amplifiers) use an erbium-doped fiber to eliminate the need for transforming a signal from optical to electrical and back again. The optical signal is amplified within the fiber by a laser operating at a wavelength of 980 nm or 1480 nm, used to excite the erbium atoms, which then emit large numbers of photons when triggered by the much weaker incoming optical signal of the same wavelengths as the incoming signal. This results in an amplified version of the input signal at the output of the EDFA.

Most telecom wavelengths operate in the C-band (1520-1570 nm) or the L-band (1570-1620 nm), and the pump laser acting upon the signal will disrupt that precise wavelength – particularly problematic in a fiber accepting multiple communication channels.

In traditional EDFA modules, a pair of fiber components is applied to correct the EDFA's output signal. A GFF is used to "flatten," or even out, the outgoing amplified signal. This filter operates in tandem with a 980 nm-blocking (or 1480 nm-blocking) wavelength-division multiplexer (WDM), the latter used to minimize interference cause by the pump laser.

What is a Hybrid Gain Flattening Filter, and what Advantages Does it Offer?

Iridian Spectral Technologies has developed what is referred to as a Hybrid GFF, which combines the functionality of both a WDM and the GFF on one component. Specifically, a Hybrid GFF can block the

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Iridian Spectral Technologies has developed what is referred to as a Hybrid GFF, which combines the functionality of both a WDM and the GFF on one component. Specifically, a Hybrid GFF can block the pump laser from light in the range of approximately 980 nm or 1480 nm while providing gain flattening for signal light amplification — without the need for an additional pump wavelength blocking filter. This article explains what a Hybrid gain flattening filter (GFF) is and how it works. It also details the advantages of using Iridian Spectral Technologies' Hybrid GFFs in lieu of a conventional two-filter setup in EDFA and other optical filter applications.

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