

# Erbium/Ytterbium Co-doped LMA Double Clad Fibers



Nuferm's Large Mode Area (LMA) and Polarization Maintaining LMA (PLMA) Er/Yb co-doped fibers feature a unique low NA (0.09) core design, achieved without sacrificing high pump conversion efficiency and developed for applications where robustly single-mode output beam quality is critical. The high NA (0.46) cladding waveguide (250 and 300  $\mu\text{m}$ ) allows for efficient coupling of high pump powers, while the large core diameters (25 and 30  $\mu\text{m}$ ) maintain a large mode field diameter and short device length thereby minimizing deleterious nonlinear effects such as SBS and SRS. The design of these LMA products has been finely tuned to achieve ultra-high efficiencies while suppressing parasitic effects at 1  $\mu\text{m}$ , offering unmatched stability when operating at high powers. Utilizing the NuCOAT™ coating technology, these LMA fibers provide excellent preservation of beam quality and extended operating life at the high power levels demanded by today's industrial fiber laser applications.

## Typical Applications

- High power lasers and amplifiers emitting around 1.5  $\mu\text{m}$
- Single frequency systems
- Military and commercial LIDAR
- High peak power, pulsed fiber amplifiers

## Features & Benefits

- NuCOAT™ fluoroacrylate coating — Greater fiber durability in extreme environmental conditions
- Unique low NA Er/Yb co-doped core design — Few moded core, for robust single-mode beam quality
- Large mode field diameter — Increased threshold for non-linearities
- Optimized, high efficiency core glass composition — Suitable for high power operation
- All fiber proof tested to > 100 kpsi — Critical for ensuring long term reliability when coiling

## Optical Specifications

|                        | PLMA-EYDF-25P/300-HE              | LMA-EYDF-25P/300-HE               | LMA-EYDF-30P/250-HE                |
|------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| Operating Wavelength   | 1530 – 1625 nm                    | 1530 – 1625 nm                    | 1530 – 1625 nm                     |
| Core NA                | 0.090                             | 0.090                             | 0.090                              |
| First Cladding NA (5%) | $\geq 0.46$                       | $\geq 0.46$                       | $\geq 0.46$                        |
| Cladding Attenuation   | $\leq 30.0$ dB/km @ 1095 nm       | $\leq 30.0$ dB/km @ 1095 nm       | $\leq 30.0$ dB/km @ 1095 nm        |
| Cladding Absorption    | $2.90 \pm 0.50$ dB/m at 915 nm    | $2.60 \pm 0.50$ dB/m at 915 nm    | $6.00 \pm 1.00$ dB/m at 915 nm     |
| Core Absorption        | $85.0 \pm 15.0$ dB/m near 1535 nm | $85.0 \pm 15.0$ dB/m near 1535 nm | $100.0 \pm 20.0$ dB/m near 1530 nm |
| Birefringence          | nominal $1.5 \times 10^{-4}$      | N/A                               | N/A                                |

## Geometrical & Mechanical Specifications

|                                  | PLMA-EYDF-25P/300-HE                     | LMA-EYDF-25P/300-HE                      | LMA-EYDF-30P/250-HE                      |
|----------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Cladding Diameter                | $300.0 \pm 8.0$ $\mu\text{m}$            | N/A                                      | N/A                                      |
| Cladding Diameter (flat-to-flat) | N/A                                      | $300.0 \pm 8.0$ $\mu\text{m}$            | $250.0 \pm 8.0$ $\mu\text{m}$            |
| Core Diameter                    | $25.0 \pm 2.0$ $\mu\text{m}$             | $25.0 \pm 2.0$ $\mu\text{m}$             | $30.0 \pm 3.0$ $\mu\text{m}$             |
| Coating Diameter                 | $450.0 \pm 15.0$ $\mu\text{m}$           | $450.0 \pm 15.0$ $\mu\text{m}$           | $350.0 \pm 10.0$ $\mu\text{m}$           |
| Core/Clad Offset                 | $\leq 2.00$ $\mu\text{m}$                | $\leq 2.00$ $\mu\text{m}$                | $\leq 3.00$ $\mu\text{m}$                |
| Coating Material                 | Low Index Polymer<br>NuCOAT-FA           | Low Index Polymer<br>NuCOAT-FA           | Low Index Polymer<br>NuCOAT-FA           |
| Proof test Level                 | $\geq 100$ kpsi (0.7 GN/m <sup>2</sup> ) | $\geq 100$ kpsi (0.7 GN/m <sup>2</sup> ) | $\geq 100$ kpsi (0.7 GN/m <sup>2</sup> ) |



Custom developed fiber (FUU) specifications are subject to change without notice. Other configurations such as alternative form factors, optimized cut-off and UV cured color coating may be available. Let us know how Nuferm can assist with your requirements.



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# 30/250 Passive LMA Double Clad Fibers



Nuferm's passive series of Large Mode Area (LMA) double clad fibers are ideal for high power monolithic fiber lasers and amplifiers. These passive fibers are based on a 30  $\mu\text{m}$  diameter core and 250  $\mu\text{m}$  diameter clad size with a low NA (0.06) core and are designed to work well with the active Yb-doped 30/250 LMA fibers. These fibers utilize the latest fiber design and NuCOAT™ coating technology to ensure excellent preservation of beam quality and extended operating life at the high power levels demanded by today's industrial fiber laser applications. These fibers are available in both non-PM and PANDA-style PM fibers.

## Typical Applications

- Monolithic high power fiber lasers and amplifiers
- LMA fiber couplers, and pump combiners
- High power pump and signal pigtails
- Military, industrial and medical

## Features & Benefits

- NuMATCH™ — Optimized compatibility with 30/250 active fibers
- NuCOAT™ fluoroacrylate coating — Greater fiber durability in extreme environmental operating & storage conditions
- Optimized LMA core design — Easy to maintain single mode LP01 beam through fiber & components at high power
- All fiber proof tested to > 100 kpsi — Critical for ensuring long term reliability when coiling"

## Optical Specifications

|                        | PLMA-GDF-30/250             | LMA-GDF-30/250-M                                           |
|------------------------|-----------------------------|------------------------------------------------------------|
| Operating Wavelength   | 1060 – 1600 nm              | 1060 – 1600 nm                                             |
| Core NA                | 0.060 $\pm$ 0.010           | 0.062 $\pm$ 0.005                                          |
| First Cladding NA (5%) | $\geq$ 0.46                 | $\geq$ 0.46                                                |
| Core Attenuation       | N/A                         | $\leq$ 45.0 dB/km @ 1300 nm<br>$\leq$ 30.0 dB/km @ 1200 nm |
| Cladding Attenuation   | $\leq$ 15.0 dB/km @ 1095 nm | $\leq$ 15.0 dB/km @ 1095 nm                                |
| Birefringence          | nominal $2 \times 10^{-4}$  | N/A                                                        |

## Geometrical & Mechanical Specifications

|                      | PLMA-GDF-30/250                          | LMA-GDF-30/250-M                         |
|----------------------|------------------------------------------|------------------------------------------|
| Cladding Diameter    | 250.0 $\pm$ 10.0 $\mu\text{m}$           | 247.0 $\pm$ 3.0 $\mu\text{m}$            |
| Core Diameter        | 30.0 $\pm$ 2.5 $\mu\text{m}$             | 30.0 $\pm$ 2.0 $\mu\text{m}$             |
| Coating Diameter     | 400.0 $\pm$ 20.0 $\mu\text{m}$           | 395.0 $\pm$ 15.0 $\mu\text{m}$           |
| Core/Clad Offset     | N/A                                      | $\leq$ 2.00 $\mu\text{m}$                |
| Clad Non-Circularity | N/A                                      | $\leq$ 0.5 %                             |
| Proof test Level     | $\geq$ 100 kpsi (0.7 GN/m <sup>2</sup> ) | $\geq$ 100 kpsi (0.7 GN/m <sup>2</sup> ) |

Coating Requirements: Low Index Polymer Coating.  
Designed to work with 30/250 LMA Yb-doped active fibers.



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Standard specifications and design parameters are listed above. Specifications are subject to change without notice. Other configurations such as alternative form factors, optimized cut-off and UV cured color coating may be available. Let us know how Nuferm can assist with your requirements.