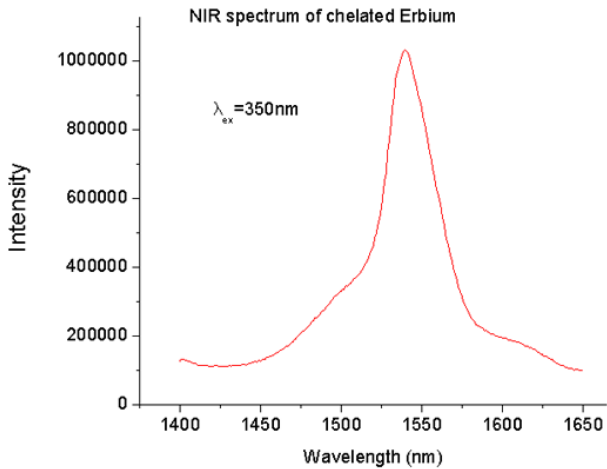


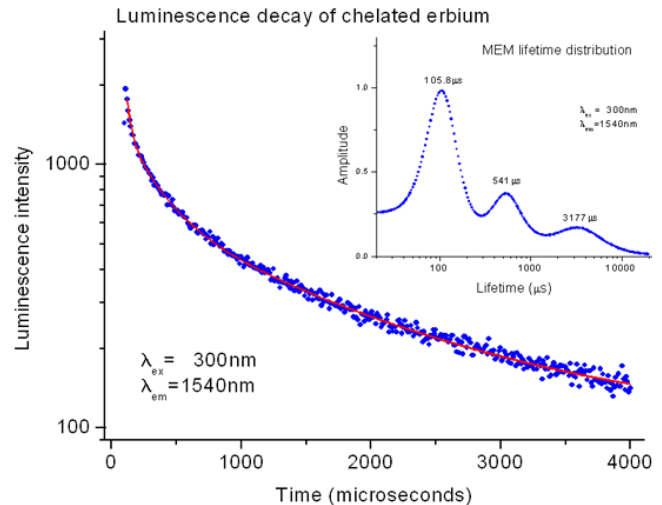
PTI Technical Note

Optical Telecommunication

The use and demand for optical fiber communication has grown rapidly and applications are numerous, ranging from global networks to desktop computers. These devices are used in the transmission of voice, data, or video over distances ranging from a meter to hundreds of kilometers. The electrical signals are converted into short light pulses generated by solid-state lasers and are injected into the fibers. The information transfer capacity is enormous compared to electrical wires and in addition optical signals are not subject to electromagnetic interference. There have been three spectral 'windows' used for optical transmission: 850 nm, 1310 nm, and 1550 nm, with the third window now becoming a globally accepted transmission band.



Emission spectrum of chelated Erbium (solid sample) measured with the NIR-PMT and solid sample holder accessory. The system features a thermoelectrically cooled, extended wavelength range NIR PMT operating in the photon counting mode.



Luminescence decay of chelated Erbium (solid sample) measured with the NIR-PMT system operating in the timeresolved 'gated' mode. The decay can be described by a broad tri-modal lifetime distribution, as shown by the MEM distribution analysis—a powerful analysis package from PTI.

There is a need to insert light amplifiers along the fiber line, especially for very long connections. One idea of amplifying the signal is based on a chelated erbium ion. Erbium belongs to the family of lanthanides and has an emission band in the NIR at about 1550 nm, so it matches perfectly the 3rd optical transmission window. The chelating molecules are either hetero-aromatics or nanoparticles and surround the ion forming a large molecular aggregate with erbium in the middle. The chelating molecules are excited in the UV or VIS by inexpensive LEDs and transfer the excitation energy by FRET to the erbium center thus promoting erbium to its excited state. Since the energy difference between the excited and ground state of erbium equals the energy of photons (1550 nm) that are propagated along the fiber, these incoming photons will stimulate the emission from erbium, thus enhancing the overall signal. The use and demand for optical fiber communication has grown rapidly and applications are numerous, ranging from global networks to desktop computers. These devices are used in the transmission of voice, data, or video over distances ranging from a meter to hundreds of kilometers. The electrical signals are converted into short light pulses generated by solid-state lasers and are injected into the fibers. The information transfer capacity is enormous compared to electrical wires and in addition optical signals are not subject to electromagnetic interference. There have been three spectral 'windows' used for optical transmission: 850 nm, 1310 nm, and 1550 nm, with the third window now becoming a globally accepted transmission band. The main task in the development of optical amplifier is to synthesize lanthanide-chelate complexes with convenient spectroscopic properties and embed these structures into optical fibers. One of the main tools for this R&D effort is a capable steady state and time-resolved luminescence systems operating in the UV and NIR regions. This type of instrumentation is necessary for measuring excitation and emission spectra of chelating particles (UV-VIS), as well the spectra, lifetimes, and relative yields of the emission of the erbium acceptor in the NIR.

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