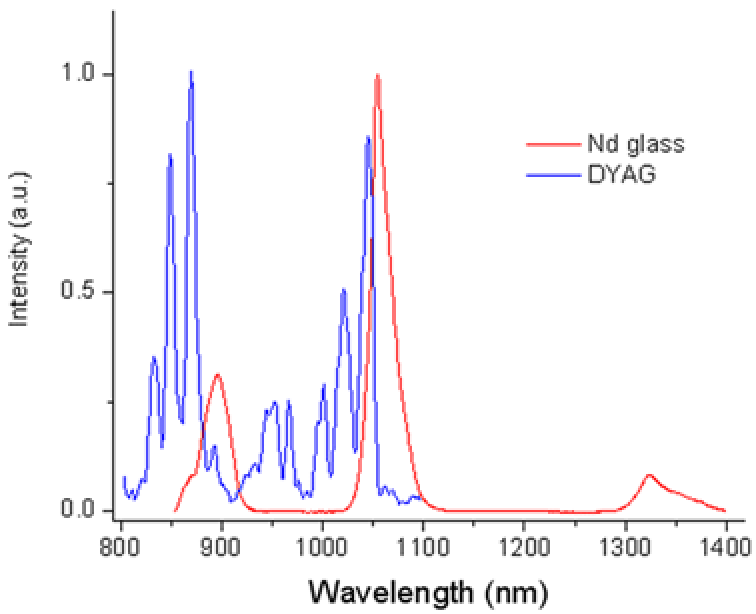
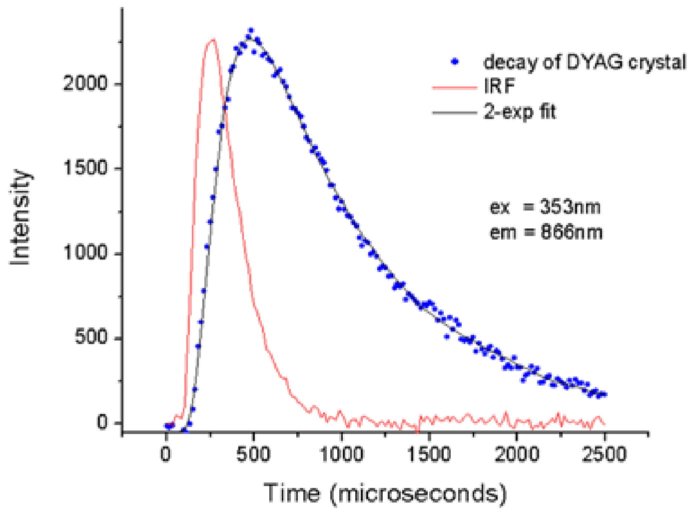
Photon Technology International

General Overview of NIR

The application of NIR systems for fluorescence and phosphorescence has been in existence for a long time in material sciences, mostly in semiconductor research. Recently, many new uses for such measurements have emerged, especially in photobiology, spearheaded by the interest in singlet oxygen. NIR measurements are particularly useful since they get away from interference in the UV and VIS part of the spectrum where any substances fluoresce. The light scattering, a notorious problem in UV-VIS fluorescence measurements, i s greatly reduced as the wavelength increases. Less interference means better signal to noise with strongly scattering biological samples. NIR light can penetrate tissue at a much greater depth than the UV and VIS – a definite advantage in tissue imaging and therapeutic applications, such as PDT. There is also a considerable research effort in the optical fiber telecommunication industry to develop infrared molecular amplifiers for the transmittance window at 1550 nm. The continuing introduction of new NIR emitters coupled with better detection and lower cost systems, continues to fuel the growth of NIR luminescence applications.



NIR emission from a DYAG crystal Nd-doped glass measured with the NIR-InGaAs. High sensitivity of the instrument permits the use of narrow slits on the emission monochromator and the resolution of narrow spectral lines of DYAG



Luminescence decay of DYAG crystal measured with the NIR-GE system operating in the time-resolved ‘gated’ mode. The system operates with the pulsed Xe lamp and a gated, liquid nitrogencooled Ge detector. The DYAG decay is double exponential with lifetimes of 114 µs (33%) and 763 µs (67%).

- Photochemistry
  - Singlet oxygen is frequent byproduct
- Geology
  - NIR luminescence of minerals
- Forensic science
  - Identifying forged documents
- Photobiology and photomedicine
  - Singlet oxygen detection (1270 nm)
- Cancer treatment
  - Photodynamic therapy (PDT)
- Photobiology
  - Photodegradation caused by singlet oxygen
- Photosensitized oxidations
  - Photooxidation of environmental pollutants
- Optical fiber communication
  - Optical amplifiers (e.g. chelated Er^{++} , 1540 nm)
- Agriculture
  - Development of environmentally friendly pesticides
- And more...

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