MDT

Monoclinic Double Tungstate

As a new European crystal manufacturer, we are introducing MDT crystals (Monoclinic Double Tungstate) as our first product in the laser crystal market. Two of the monoclinic double tungstates (KYW and KGdW) are well known as the lowest threshold hosts for lamp pumped Nd pulsed lasers and as Raman selfconverters.
In modern diode pumped systems, the MDT family of crystals possess a very high figure of merit (combination of suitable parameters) as laser materials. With recently demonstrated continuous-wave emission, the most promising member of the MDT family is undoubtedly KYbW. In addition, KYbW possesses other exotic and attractive characteristics:

- An extremely short absorption length of 13.3 µm at 980 nm (the lowest known for a solid state laser medium), and 100 µm absorption length at plateau-region around 940 nm.
- The lowest known room temperature laser quantum defect at 1.6%.
- KYbW could be considered as a new universal laser host with the same (ytterbium determined) pump spectrum for all dopants, but dopant determined emission. In this way, the Yb acts as a very efficient sensitizer. Possible dopants are the lanthanides, including Tm (water absorption 2 µm) and Nd (eye-safe 1.54 µm).

The laser passive MDT (pMDT), in which the tri-valent ion could be Y, Gd, Lu or their mixture, are also very promising laser hosts. Yb:pMDTs are today the most efficient medium for thin disc design applications and diode pumped femtosecond lasers. The absorption cross section of Yb^{3+} is nearly constant as a function of concentration and type of pMDT. Thus the absorption/emission data which is presented for the stoichiometric KYbW can simply be scaled to low doped pMDT.
Yb:pMDT and KYbW are also among the most promising candidates for optical refrigerators.

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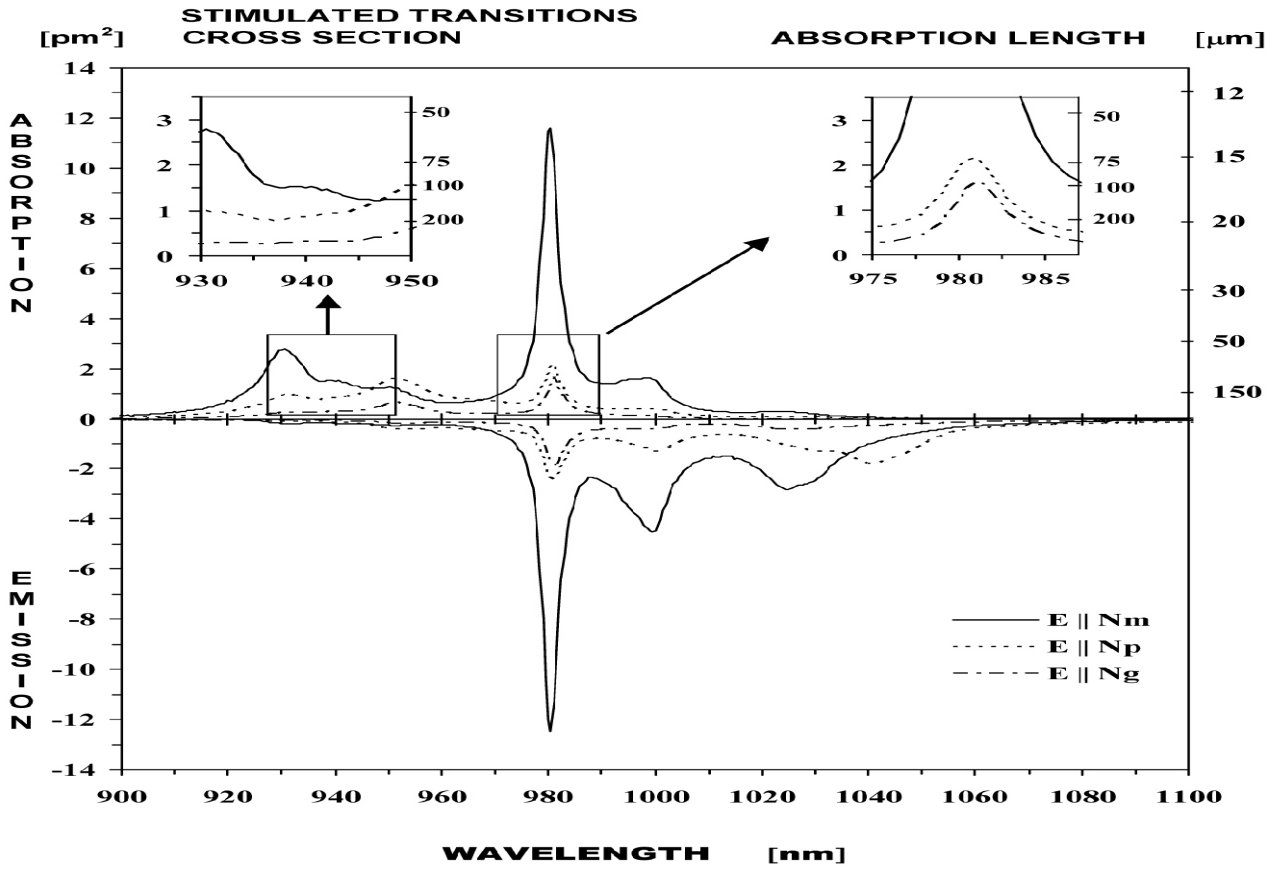

The refractive index ellipsoid of the MDT crystals is practically λ- and T-dispersion-free; with identical orientation for all isostructures. This makes it possible to create Sandwich Structure Single Crystals (3SC, Vision Crystal Tech AG patent pending). 3SC is a sandwich-like composition from Yb substituted isostructures of KYbW with the same crystallographic orientation. The 3SC consists of at least two of these layers, one of which is laser active including Yb and the other is pMDT. Optically the 3SC structure behaves like a bulk monoclinic single crystal. 3SC structures can be produced by hydrothermal growth, liquid phase epitaxy, vacuum deposition, and diffusion bonding.

The refractive index ellipsoid can be controllably scaled in these structures. In general, the average refractive index increases with decreasing ionic radius, hence KYbW and KLuW have the largest indices.

Exploiting the short absorption length and small quantum defect of Yb in the laser layer, and the properties of the pMDT layer (mechanical support, controllable refractive index, high cubic non-linearity) various laser schemes are feasible. Among them are: a chip laser without coupling optics; an ultra thin disc design for high power single frequency generation; planar waveguide lasers; and index matched 3SC construction using KYbW-K(Lu_xY_{1-x})W for ultra high power scalable lasers without losses from amplified spontaneous emission.