BBO
Beta Barium Borate (BBO) crystal includes wide transparency (~190 to 3500 nm) and phase matching ranges, large non-linear coefficient, high damage threshold and excellent optical homogeneity. Therefore, BBO provides an attractive solution for various non-linear optical applications like OPO, OPA, OPCPA and other. As a result of large thermal acceptance bandwidth, high damage threshold and small absorption BBO well suits for frequency conversion of high peak or average power laser radiation. The large spectral transmission range as well as phase matching, especially in UV range, makes BBO perfectly suitable for frequency doubling of Dye, Argon and Copper vapour laser radiation, effective cascade harmonic generation (Frequency doublers, triplers, parametric amplifiers and wave mixers) of wide spread Nd:YAG as well as of Ti:Sapphire and Alexandrite laser radiation. Both angle tuned Type I (oo-e) and Type II (eo-e) of phase matching can be obtained.

LBO
Lithium Triborate (LBO) is unique in many aspects, especially its wide transparency range (~160 – 2600 nm), relatively large effective SHG coefficient (about three times that of KDP), high damage threshold, wide acceptance angle, small walk-off and good chemical and mechanical properties. LBO allows temperature-controllable non-critical phase-matching (NCPM) for both Type I and Type II in a wide spectral range.

CLBO
CLBO (CsLiB6O10) (cesium lithium borate) is well known for its very high optical damage threshold (25GW/cm² at 1064nm for 1 ns pulses). It also has a wide transmission range (~185 nm to 2750 nm) and is suitable for the generation of high harmonics (SHG, THG, 4HG, 5HG) of Nd:YAG laser radiation and the generation of second and third laser harmonics of alexandrite and Ti:Sapphire lasers.

KDP, KD*P (DKDP)
Potassium Dideuterium Phosphate crystals and its Isomorphs - KDP, KD*P (DKDP) are transparent in the ~160 to 2800 nm range and have high birefringence, non-linear coefficients and laser damage threshold, as well as high UV transmission. They are widely used for electro-optical applications as Q-switches for Nd:YAG, Nd:YLF, Ti:Sapphire and Alexandrite lasers, as well as for Pockels cells. The most commonly used electro-optical crystal is DKDP with a deuteration more than 98%. These crystals are grown by a water-solution method and can be grown up to very large sizes. For frequency-doubling (SHG) and tripling (THG) of Nd:YAG laser at 1064 nm, both type I and type II phase-matching can be used. KDP can also be used for frequency - quadrupling (4HG, output at 266 nm) of Nd:YAG lasers.
**KTP**

Potassium Titanyl Phosphate (KTP, KTIOPO₄) is a non-linear optical crystal, transparent from ~350 to 4400 nm, which possesses excellent non-linear, electro-optical and acousto-optical properties. It exhibits high optical quality, relatively high non-linear coefficient (about 3 times better SHG efficiency than KDP), rather high optical damage threshold, wide acceptance angle, small walk-off and type I and type II non-critical phase-matching (NCPM) in a wide wavelength range. KTP is the most commonly used material for frequency doubling of Nd:YAG lasers and other Nd-doped lasers, particularly at the low or medium power density. It is also cheaper than BBO or LBO.

**KTA**

Potassium Titanyle Arsenate (KTA, KTiOAsO₄), or KTA crystal, is an excellent non-linear optical crystal for Optical Parametric Oscillation (OPO) Applications. It is transparent in the ~350 to 5500 nm range, has large non-linear and electro-optical coefficients, a wide angular bandwidth and small walk-off. OPO devices based on KTAs are reliable, solid state sources of tunable laser radiation exhibiting energy conversion efficiencies above 50%. KTA has significantly lower absorption in 2.0-5.0 µm range compared with KTP non-linear crystal. KTA crystal also exhibits higher damage threshold than many other non-linear crystals (typically >1.5 GW/cm² for 10ns pulses @ 1064 nm) and is a non-hygroscopic crystal.

**Focus on Infra Red light generation**

A range of nonlinear optical crystals have been developed to generate IR laser radiation in the < 1 to 18 µm range. The most common are AgGaSe₂ and AgGaS₂ but others are available too such as ZnGeP₂ or GaSe. Those crystals have large effective optical non-linearity, wide spectral and angular acceptance, broad transparency range and are not too sensitive to temperature.

**AgGaSe₂**

Silver Thiogallate crystal is transparent in the 0.55 – 12 µm range. It has a reasonable non-linear coefficient (although smaller than some of the other laser crystals) and a wide transmission range starting in the visible. It also has low optical absorption and scattering, low wave-front distortion. Among commercially available crystals, AgGaSe₂ has the highest figure of merit for non-linear interactions in the near and deep infrared. It is commonly used for DFG applications (Difference Frequency Mixing) with Nd:YAG, OPOs, ultrafast Ti:Sa systems or Dye lasers to generate laser radiation in the 3 to 12 µm range. It can also be used as an SHG for CO₂ lasers.

**AgGaS₂**

Silver Selenogallate crystal has transparency in the 0.75 to 18 µm range, being best in the 0.9 to 16 µm range. Its wide phase matching is ideal for OPO applications, being pumped by commonly available lasers. Tuning from 2.5 to 12 µm was obtained when pumped by an Ho:YLF laser at 2.05 µm; it has also been shown as an excellent crystal for non-linear three-wave interactions or as an SHG for CO₂ lasers.

**GaSe**

Gallium Selenide has transparency in the 0.65 to 18 µm range and can be used for many IR application such as: SHG of pulsed CO, CO₂ and chemical DF-laser; infrared pulses generation via difference frequency mixing of neodymium and infrared dye laser; OPG light generation within 3.5 to 18 µm. Thin GaSe crystal plates are also available for ultrafast THz generation.

**ZnGeP₂**

ZnGeP₂ has transmission band edges at 0.74 and 12 µm but is most useful from 1.9 to 8.6 µm and from 9.6 to 10.2 µm. ZnGeP₂ crystal has the largest non-linear optical coefficient and a relatively high laser damage threshold. It can be used for SHG of pulsed CO₂ and chemical DF-laser; infrared tuneable radiation by Optical Parametric effects when pumped by commercial lasers in the NIR.