Synthesis of Nanostructured Pure and Cr-doped $NaAl(WO_4)_2$

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An increasing interest in tunable and very short pulse solid-state lasers was observed during the last years due to their promising application in modern science and technology. This stimulated the studies on single crystal materials with a broadband emission in the near-infrared region. Cr-doped $NaAl(WO_4)_2$ is a potential laser active media because of high absorption, efficient pumping with the use of visible-range semiconductor diode lasers and broad laser emission. However, the production of single crystals as laser active media from this tungstate is related with a number of problems, first of all due to the low growth velocity and anisotropy. An effective approach to overcoming the crystal growth problems is to produce transparent ceramics, replacing the single crystals.

As a first step to this task nanostructured pure and Cr -doped $NaAl(WO_4)_2$ was synthesized by sol-gel (modified Pechini), solid state reaction as well as co-precipitation methods. The experiments show that sol-gel and solid state reaction methods are not suitable because of several secondary (mainly sodium tungstates) phases crystallize in parallel to $NaAl(WO_4)_2$. Co-precipitation method gives good possibilities pure nanosized $NaAl(WO_4)_2$ to be obtained. The dimensions, size distribution, morphology and reactivity of the particles were tested depending on conditions of powder preparation. It was established that the powder characteristic mainly depend on the thermal treatment conditions and Cr concentration. X-ray and TEM analyses show that the dimension of the particle could vary between 5 – 50 nm when different conditions for powder preparation are used.

References

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