

## Thermal Conductivity of NaLaS<sub>2</sub> – CaS System

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NaLaS<sub>2</sub> has a wide region of optical transmission (0.45 - 20 μm). This compound is an attractive material for application in IR engineering. The low thermal conductivity coefficient value limits the application of NaLaS<sub>2</sub>. The thermal conductivity can be increased in NaLaS<sub>2</sub> - CaS solid solutions as in this system the drop in structure imperfection occurs upon the transition from NaLaS<sub>2</sub> to CaS. In the present work, the composition and temperature (80 - 400 K) dependences of the thermal conductivity of NaLaS<sub>2</sub> - CaS solid solutions have been investigated in order to clear up an influence of the imperfection change on the thermal conductivity. The solid solutions samples for this investigation were prepared by hot vacuum recrystallization pressing of powder of the corresponding composition. The thermal conductivity coefficient was measured by a steady-state absolute technique.

The investigation showed that in the region below 200 K the thermal conductivity coefficient of all solid solutions is inversely proportional to temperature. It is typical for phonon heat transfer and phonon scattering by phonons and defects. When temperature increases, the deviation from that temperature dependence appears. It is caused by a contribution of the photon component in heat transfer. The CaS concentration in solid solution is more the deviation occurs at higher temperature. In the NaLaS<sub>2</sub> - CaS solid solution system the photon contribution to the thermal conductivity reaches amounts to 10% at 400 K. With increasing CaS concentration, the thermal conductivity coefficient increases. With a change of composition in the NaLaS<sub>2</sub>- CaS system, variation in the thermal conductivity is not monotonical. From NaLaS<sub>2</sub> to compounds with 40 mol % CaS the thermal conductivity increases by 8 %; as CaS concentration changes from 40 to 90 mol % the thermal conductivity rises 2.3 times. That behavior of thermal conductivity composition dependence is caused by a change of the structure imperfection, anharmonicity of lattice vibrations, strength of chemical bounding, mean atomic weight as the solid solution composition changes in NaLaS<sub>2</sub>- CaS system.