A40

SYMMETRY AND OPTICAL PROPERTIES OF RARE EARTH DOUBLE TUNGSTATES

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The rare-earth double tungstate single crystals $ARe(WO_4)_2$ (A = K, Rb and Re = Dy, Er, Ho, Nd) are attractive materials as laser hosts [1] and of a special interest for a possible realization of both magnetic and structural phase transitions [2]. These single crystals were grown by the High Temperature Solution Growth technique and crystallize in α-$KY(WO_4)_2$ structure with C_{2h}^6(C2/c) symmetry [3]. The chain-layered crystallographic structure and the low symmetry of double tungstates are responsible for the strong anisotropy of many physical properties.

The spectroscopic investigations were made in a broad spectral (from 6000 cm^{-1} up to 40000 cm^{-1}) and temperature (from 1.1K to 300K) range. They have shown that rare earth double tungstates belong to the class of biaxial and pleochroic (trichroic) crystals. The results of the optical investigation in the phonon spectral range between 1000 cm^{-1} and 2000 cm^{-1} in $KHo(WO_4)_2$ are presented for the first time. The phonon absorption spectra are also trichroic.

In the present work we have tried to explain the trichroism for the rare earth double tungstates from the point of view of symmetry. The analysis was carried out for symmetries C2 and 2/m. While the C2 symmetry corresponds to the symmetry of the nearest neighbourhood of rare earth ions, the 2/m symmetry corresponds to the symmetry of the lattice of rare earth ions.

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