

**SOLID-PHASE SYNTHESIS OF TERBIUM AND DYSPROSIUM
DOUBLE TITANATES AND THEIR THERMODYNAMIC PROPERTIES**

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Solid solutions of double titanates of terbium-lutetium and dysprosium-lutetium with the general formula $(\text{Ln}_{1-x}\text{Lu}_x)_2\text{Ti}_2\text{O}_7$ ($\text{Ln}=\text{Tb},\text{Dy}$) in the ratios of Tb:Lu and Dy:Lu as 25:75, 50:50 and 75:25 at.% were obtained by solid-phase synthesis. The synthesis was carried out in a SH-FU-4MS furnace in a protective argon atmosphere in several stages: at temperatures from 800 to 1300°C for 8 hours, at 1400°C for 10 hours, at 1500°C for 12 hours, and the final stage at 1550°C for 24 hours with the total annealing time of up to 104 hours for terbium-lutetium titanates and up to 128 hours for dysprosium-lutetium titanates.

The exposure of diffraction patterns was made by a SmartLabRigaku X-ray diffractometer. X-ray structural analysis was performed using SmartLab software (Rigaku) and the full-profile analysis method by PDF-2024. The values of statistical parameters of fitting have been obtained in the range of R_p from 4.1 to 5.7% and R_{wp} from 5.5 to 8.3%, which is a satisfactory indicator and confirms the crystal structure of the samples corresponding to the type of pyrochlore of cubic syngony with the space group Fd-3m with a lattice parameter a from 10.02 to 10.12 Å.

The heat capacity measurements and thermodynamic functions calculations have been carried out for the samples of double titanates of terbium and dysprosium. Using the experimentally obtained data for double titanates of terbium and dysprosium based on lutetium and processed by methods of mathematical statistics, the smoothed temperature dependences of the heat capacity and tabulated values of thermodynamic functions of double titanates of terbium and dysprosium have been obtained (Table).

For the lanthanide titanates studied the excess components have been obtained over the entire temperature range. All of them contribute significantly to the heat capacity, at the same time some of them have a complex structure consisting of more than one maximum due to the presence of energy contributions from various excited levels.

Thermodynamic functions of terbium-lutetium and dysprosium-lutetium titanates

Function	Tb ₂₅ :Lu ₇₅	Tb ₅₀ :Lu ₅₀	Tb ₇₅ :Lu ₂₅	Dy ₂₅ :Lu ₇₅	Dy ₅₀ :Lu ₅₀	Dy ₇₅ :Lu ₂₅
$C_{p(298)}$	219.5±1.4	218.6±1.0	217.4±1.1	214.0±1.1	218.1±1.6	219.8±1.4
$S_{(298)}$	262.1±2.6	268.0±3.1	273.2±2.2	260.5±3.1	266.4±3.3	270.1±2.9
$H_T - H_{0(298)}$	37.21±0.3	37.68±0.2	37.86±0.2	37.03±0.2	38.00±0.3	38.55±0.3

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