

Optical properties of U^{4+} -doped KPb_2Cl_5 single crystal.

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Rok wydania

2010

Czasopismo

Structural Chemistry

Numer woluminu

21

Strony

455-459

DOI

10.1007/s11224-009-9559-0

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

A potassium lead(II) pentachloride (KPC) non-linear single crystal doped with U^{4+} ions has been obtained by the Bridgman–Stockbarger method. Unpolarized absorption, excitation, and emission spectra of the crystal were recorded at room temperature in wide spectral ranges and are discussed. For the first time, the Judd–Ofelt intensity analysis of $5f^2-5f^2$ transitions in U^{4+} -doped single crystals has been performed. The experimental lifetimes for emitting levels in the visible spectral region are compared with those theoretically achieved by using the Judd–Ofelt approach. Bands [11], a strong emission in the infrared region from the $4F_{3/2}$ and $4I_{11/2}$ levels was observed. Besides, optical properties of U^{4+} ions doped in $ThCl_4$, $ThBr_4$, $ThSiO_4$, Ba_2YCl_7 , and $CsCdBr_3$ single crystals have been also reported [12–16]. Upconversion of light excitation was observed in $U^{4+}:Ba_2YCl_7$ single crystals [15]. The spectroscopic investigations of trivalent lanthanide ions in solutions, glasses, and crystals have been rationalized on the basis of the Judd–Ofelt (JO) theory [17–19]. The determined phenomenological parameters X_2 , X_4 , and X_6 were subsequently used for the calculation of the spontaneous emission coefficient (A), the radiative life-times (sR), and branching ratios (bR). In this article, we present an analysis of room temperature absorption and emission spectra of U^{4+} -doped KPb_2Cl_5 single crystal. For the first time the Judd–Ofelt theory has been successfully applied for U^{4+} ions.

Słowa kluczowe

Uranium($4+$) laser ion, KPb_2Cl_5 host crystal, Judd–Ofelt intensity analysis, Absorption spectra, Emission spectra, Laser parameters

Adres publiczny

<http://dx.doi.org/10.1007/s11224-009-9559-0>

<http://link.springer.com>

Plik został wygenerowany dnia 2026-08-24 07:59:13

Adres w repozytorium <https://old.chem.uni.wroc.pl/pl/repozytorium/eDPBqq1>.