Compositional dependence of Stark splitting and spectroscopic properties in Yb^{3+}-doped lead silicate glasses.

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Rok wydania

2020

Czasopismo

Journal of Non-Crystalline Solids

Numer woluminu

532

Strony

119890/1-119890/5

DOI

10.1016/j.jnoncrysol.2020.119890

Kolekcja

Naukowa

Streszczenie

In this work, we explore the effect of ionic field strength of modifiers (Li^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, Sr^{2+} and Ba^{2+}) on room-temperature Stark splitting and spectroscopic properties of Yb^{3+} ions in lead silicate glasses. Our measurements show that the 'crystal-field' parameter and asymmetry degree of Yb^{3+} ion ligands are increased as a function of modifier field strength due to the corresponding higher electronegativity and bonding energy. Higher field strengths produce greater absorption σ_a and emission σ_e cross-sections, effective emission linewidth $\Delta\lambda_{eff}$ and spontaneous emission probability A_{rad} of Yb^{3+} ions. We report a 57% enhancement on σ_a, σ_e and $\Delta\lambda_{eff}$ by doubling the field strength of the modifier cations, implying Yb^{3+} ion doped lead silicate glass with high field strength modifiers (Li^+, Mg^{2+} and Ca^{2+}) may be a promising candidate for efficient laser emission operation.

Słowa kluczowe

Yb3+ ion, Lead silicate glass, Modifier field strength, Stark splitting, Spectroscopic properties

Adres publiczny

http://dx.doi.org/10.1016/j.jnoncrysol.2020.119890

Strona internetowa wydawcy

http://www.elsevier.com

Język

Angielski

Typ publikacji

Artykuł