Photoluminescence of Perovskite Nanosheets Prepared by Exfoliation of Layered Oxides, $K_2Ln_2Ti_3O_{10}$, $KLnNbO_7$, and $RbLnTa_2O_7$ (Ln: Lanthanide Ion)

大学院自然科学研究科	助教	伊田進太郎
〃	前期課程	緒方盟子
アメリカ ペンシルバニア州立大学	博士研究員	エグチミハル
〃	博士研究員	W. Justin Youngblood
〃	教授	Thomas E. Mallouk
大学院自然科学研究科	教授	松本泰道

Abstract:

Luminescent perovskite nanosheets were prepared by exfoliation of single- or double- layered perovskite oxides, $K_2Ln_2Ti_3O_{10}$, $KLnNb_2O_7$, and $RbLnTa_2O_7$ (Ln: lanthanide ion). The thickness of the individual nanosheets corresponded to those of the perovskite block in the parent layered compounds. Intense red and green emissions were observed in aqueous solutions with $Gd_{1.4}Eu_{0.6}Ti_3O_{10}$- and $La_{0.7}Tb_{0.3}Ta_2O_7$-nanosheets, respectively, under UV illumination with energies greater than the corresponding host oxide band gap. The coincidence of the excitation spectrum and the band gap absorbance indicates that the visible emission results from energy transfer within the nanosheet. The red emission intensity of the $Gd_{1.4}Eu_{0.6}Ti_3O_{10}$-nanosheets was much stronger than that of the $La_{0.90}Eu_{0.05}Nb_2O_7$-nanosheets reported previously. The strong emission intensity is a result of a two-step energy transfer cascade within the nanosheet from the Ti-O network to Gd^{3+} and then to Eu^{3+}. The emission intensities of the $Gd_{1.4}Eu_{0.6}Ti_3O_{10}$- and $La_{0.7}Tb_{0.3}Ta_2O_7$-nanosheets can be modulated by applying a magnetic field (1.3-1.4 T), which brings about a change in orientation of the nanosheets in solution. The emission intensities increased when the excitation light and the magnetic field directions were perpendicular to each other, and they decreased when the excitation and magnetic field were collinear and mutually perpendicular to the direction of detection of the emitted light.

(Journal of American Chemical Society, Vol. 30, No. 52, p.7052-7059, 2008)