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Anion stoichiometry and optical properties of the perovskite-type $La_{1-x}Ba_xTa(O,N)_3$ and $LaTi_{1-y}Nb_y(O,N)_3$ solid solutions optimized for red pigments

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Abstract

We have demonstrated that a color of the perovskite-type LaTiO2N oxynitride could be tuned from orange through yellow and green to pale gray or white by proper adjustment of the O/N ratio. This is because the width of the bandgap is controlled by the extent of overlap of the valence orbitals, O2p and N2p ones.

LaTaON2, which contains more nitrogen amount than LaTiO2N, can be expected as the redder pigment. However, the ionic size of La3+ seems to be so small for accommodating the ideal perovskite that the crystal structure may be deformed to be monoclinic system. Distortions to bond angle of Ta-(O,N)-Ta were reported to make the bandgap wider. Such distortions are not preferable to prepare the redder pigments. In this study, we prepared solid solutions of La1-xBaxTa(O,N)3 and the compositional variation of optical properties as well as structural ones were examined. We also studied the effect of addition of NaCl as a flux during nitridation on the particle size and the distributions.

LaNbON2, whose nitrogen amount is larger than that of LaTiO2N as well, should be one of the redder pigments. Niobium is one of the candidate substituent for titanium as an electron donor since the stable valence state of niobium would be pentavalent whereas that of titanium is tetravalent. We also examined anion composition and optical properties of solid-solution of LaTi1-yNby(O,N)3 and will discuss difference in ways of variation of optical properties against the substitutions mentioned above.

Biography

Toshihiro Moriga has received his Dr,Sci. from Osaka University and had his sabbatical staying at Department of Materials Science and Engineering, Northwestern University in 1996 and 1997, IL. He is now a professor of the University of Tokushima and active in an international exchange coordinator of University of Auckland, NZ and some Indian universities and institutions (University of Pune, Dr. Babasaheb Ambedkar Marathwada University in Aurangabad and C-MET, etc.). He has published more than 130 papers in peer-reviewed journals and serving as an editorial board member of Journal of Ceramic Society of Japan and International Journal of Metals.