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-BaTiO$_3$ OXIDE SEMICONDUCTORS WITH ALIOVALENT SUBSTITUTIONS IN BARIUM SUBLATTICE.

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The aim of the presented work was to clearly explain, why the formation of semiconducting operties depends on the nature of rare-earth ions. The properties of $(Ba_{1-X}Ln_X)TiO_3$, where n = Sc, Y, Ln, Nd, Sm, Dy, Lu were investigated by thermogravimetric, X-ray diffraction analysis RD), electron microscopy and resistivity measurements. It has been shown that aliovalent bstitutions lead to the formation of perovskite structure over a wide concentration range, in which tetragonal phase, a mixture of cubic and tetragonal phase and a cubic phase exist. Semiconducting operties are formed only in tetragonal crystal system; the widest range of existence of tetragonal ase is observed in the case of aliovalent substitution of barium by yttrium. XRD shows that the duced $(Ba_{1-X}Ln_X)TiO_3$ perovskite lattice parameters $\bar{a} = (a^2c)^{1/3}$ as a function of rare-earth ion ncentration pass through a maximum. At low rare-earth ion concentrations, the increase in this ameter may be attributed to the appearance of Ti^{3+} ions, whose radius is larger than that of Ti^{4+} s. It should be noted that the increase in lattice parameter cannot be attributed either to the valent substitution of barium by rare-earth ions or to the aliovalent substitution of titanium by e-earth ions. The reduced parameter maximum corresponds to the concentration at which a istance minimum is observed. At high concentrations, this parameter decreases due to both a rease in Ti^{3+} ion concentration and the aliovalent substitution of barium by elements with aller ionic radius. It is known that in the case of complicated perovskite compounds the crystal ctroneutrality requirement and definite requirement to ion size must be met. The calculations of ic parameters for complex perovskites showed that the perovskite structure must be formed ependent of the Ln^{3+} radius value in the aliovalent substitution concentration ranges studied. The sing of semiconductor properties in $(Ba_{1-X}^{2+}Ln_X^{3+})TiO_3$ perovskites can be associated with the mation of solid solutions $(1\text{-}X)Ba^{2+}Ti^{4+}O_3$ - $xLn^{3+}Ti^{3+}O_3$. The calculation of steric parameters for $^{3+}Ti^{3+}O_3$ showed that the perovskite structure must form when Ln is Y and La-Ho and must not m when Ln is Tm, Yb and Lu. The ionic radius of erbium is close to the maximum radius, for ch the existence of the $Ln^{3+}Ti^{3+}O_3$ perovskite structure is still possible. It has been found that n the $(Ba_{1-X}Ln_X)(Ti_{1-X}^{4+}Ti_X^{3+})O_3$ solid solution is oxidized, barium metatitanate and phase of Ti_2O_7 type are formed at grain boundaries, leading to the formation of a dielectric interlayer at in boundaries.