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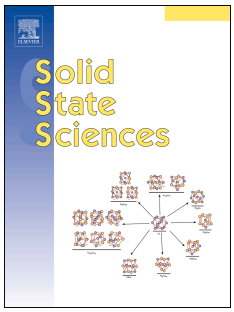

New silicate-germanate $Cs_2Pb_2[(Si_{0.6}Ge_{0.4})_2O_7]$ from the series $A_2Pb_2[B_2O_7]$, A = K, Cs, B = Si, Ge with the umbrella-like $[PbO_3]^{4-}$ group

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Title: New silicate-germanate $Cs_2Pb_2[(Si_{0.6}Ge_{0.4})_2O_7]$ from the series $A_2Pb_2[B_2O_7]$, A = K, Cs, B = Si, Ge with the umbrella-like $[PbO_3]^{4-}$ group

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Keywords: Silicate-Germanate $Cs_2Pb_2[(Si_{0.6}Ge_{0.4})_2O_7]$; Hydrothermal Synthesis; Single Crystal Structure; Umbrella-like $[PbO_3]^{4-}$ group, Structural Relations

Abstract: New silicate-germanate $Cs_2Pb_2[(Si_{0.6}Ge_{0.4})_2O_7]$ was synthesized in multi-components hydrothermal solution with 20 w.% concentration of Cs_2CO_3 mineralizer, pH =10. Novel mixed compound belongs to the structure type $A_2Pb_2[B_2O_7]$ previously indicated for powders with A=K, B=Si or Ge. Singe crystal structure determination of $Cs_2Pb_2[(Si_{0.6}Ge_{0.4})_2O_7]$ revealed the need for the correction of the space group of the earlier suggested structural model from *P*-3 to *P*-3*m*1, as well as for the splitting of the Pb-atom position. Umbrella-like groups $[PbO_3]^{4-}$ are located between $[(Si,Ge)O_4]^{4-}$ tetrahedra in mica-like honeycomb layers and play the role of tetrahedra with the Pb-lone-pair as the forth apex. Crystal chemical comparison revealed similarities and differences with the classical structure type of α-celsian $Ba[Al_2Si_2O_8]$ with the tetrahedral double layer. Recently investigated nonlinear optical acentric borates $Pb_2(BO_3)(NO_3)$ and $Pb_2(BO_3)Cl$ are both related to this structural type, possessing umbrella-like groups $[PbO_3]^{4-}$ and honeycomb layers $[Pb_2(BO_3)]^{+}$ with the BO_3-triangles on the tetrahedral positions.