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Authors: Ting Chen, Jianrui Zha, Xiaojun Zhang, Xiaobo Hu, Weihui Jiang, Zhixiang Xie, Wan Jiang



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Synthesis and characterization of $\text{Pr}_x\text{Zr}_{1-x}\text{SiO}_4$ ($x=0-0.08$) yellow pigments via non-hydrolytic sol-gel method

Ting Chen^{a*}, Jianrui Zha^a, Xiaojun Zhang^a, Xiaobo Hu^a, Weihui Jiang^{b*}, Zhixiang Xie^a, Wan Jiang^b

^a*School of Material Science and Engineering, Jingdezhen Ceramic Institute, Jingdezhen 333001, China*

^b*National Engineering Research Center for Domestic & Building Ceramics, Jingdezhen 333001, China*

Abstract

Yellow inorganic pigments $\text{Pr}_x\text{Zr}_{1-x}\text{SiO}_4$ ($x=0-0.08$) have been prepared by a novel non-hydrolytic sol-gel (NHSG) method at 750 °C for 2 h. Replacing Pr^{4+} for Zr^{4+} in ZrSiO_4 increased the cell volume and changed the color from white to yellow gradually. The Si–O–Zr and Si–O–Pr bands were observed in the FT-IR spectra of xerogel, indicating it could reach homogeneous mixing at the atomic level. Therefore, it promoted the solid solution reaction between Pr and zircon at low temperature. The samples exhibit high doping limitation ($x=0.08$) and brilliant yellow hue ($b^*=69.48$) in contrast with the previously reported praseodymium zircon yellow pigments. The intense of yellow hue was increased with increasing the Pr doping content due to the increase of $\text{Pr}^{4+}/\text{Pr}^{3+}$ species. After applying on bisque ceramic tiles, the pigment exhibited excellent coloration, high thermal stability and low solubility in molten glazes, indicating its potential application in ceramic decoration.

Keywords: Ceramic; Pigment; Zircon; Yellow; Non-hydrolytic sol-gel

* To whom correspondence should be addressed. Tel: +86-0798-8499162, Fax: +86-0798-8499162
E-mail: chenting@jci.edu.cn (T. Chen), jiangweihui@jci.edu.cn (W.H. Jiang)

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