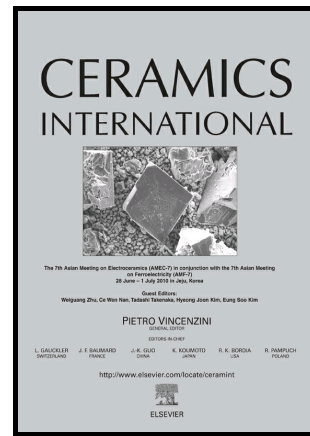


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Synthesis and characterization of novel nontoxic BiFe_{1-x}Al_xO₃/mica-titania pigments with high NIR reflectance

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Abstract

A series of novel nontoxic near-infrared (NIR) reflective pigments based on Al-doped BiFeO₃ coated mica-titania were synthesized by precipitation combined with sol-gel method. The pigments of the formula BiFe_{1-x}Al_xO₃/mica-titania (x = 0, 0.1, 0.2, 0.3, 0.4) were characterized by XRD, FE-SEM, TG-DTA, UV-vis-NIR spectrophotometer and CIE L* a* b* color scales. The results illustrate that the BiFeO₃ nanoparticles are coated on the surface of mica-titania uniformly, and the doped BiFe_{1-x}Al_xO₃/mica-titania is similar to BiFeO₃/mica-titania composite in morphology. Furthermore, the absorption edge of composite pigments shift to shorter wavelength (533 nm to 495 nm) can be attributed to O_{2p}-Fe_{3d} charge transfer transitions and change the color of the pigments from brown to orange. Additionally, the NIR solar reflectance of the powdered pigments and pigmented coatings were measured. The results reveal that with the increase of progressive doping of Al³⁺ for Fe³⁺, the NIR solar reflectance of the pigments increase gradually and exhibit higher NIR solar reflectance (R* ≥ 47.8%) than the conventional pigment of similar color. Moreover, we also evaluated the thermal and chemical stability of the pigments. In conclusion, the pigments have the potential to be applied as “cool pigments”.

Keywords: BiFe_{1-x}Al_xO₃; composite pigment; nontoxic; NIR reflectance; cool pigments.

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