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Cupper doping TiO_2 influence on photocatalytic properties

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Due to increasing industrialization growth, alternative and environmentally clean processes search for control in the disposal of waste in the environment. The heterogeneous photocatalysis has aroused scientific and technological interest due to its potential. Owing to this, the motivation of this study stems from the need of understanding the photocatalytic properties of the materials for later applying them suitably in the degradation of organic compounds. The present study has the objective of investigating the influence of Cu doping on TiO_2 in the structural, optical and photocatalytic properties. For this, the materials were synthesized by the polymeric precursor method. For the understanding of their properties, the materials were characterized by X ray diffraction, Raman scattering spectroscopy, optical spectroscopy in the ultraviolet and visible region, scanning electron microscopy and photoluminescence spectroscopy. Experiments for evaluation of photocatalytic activity of materials were made to discoloration of Rhodamine-B dye. The obtained results indicated that increasing treatment temperature, 500, 600 and 700°C, led to anatase to rutile transformation in the materials. However, introduction of copper on materials treated at 500 and 600°C promoted anatase phase stabilization, while for 700°C, the introduction of dopant favored the anatase to rutile transition. For all treatment temperatures, introduction of dopant caused decreases in band gap energies, as well local order distortions, which led to the formation of energy states. These defects promoted a blueshift in the photoluminescent emission bands of materials with increasing Cu concentration. The sample containing 0.5% of copper heat-treated at 500°C showed higher photocatalytic activity, allowing discoloration of 98.3% of Rhodamine-B in 60 minutes of reaction. This sample was deposited on aluminum substrate by electrophoretic deposition method, which obtained approximately 125 μm thickness. This film had photocatalytic activity with approximately 89.5% of discoloration of Rhodamine-B in 120 minutes of reaction.

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Fabrication and properties of $Pb[(Zr_x, Ti_{(1-x)})_{0.9} (Cr_{1/5}, Nb_{1/5}, Sb_{3/5})_{0.1}]O_3$ piezoelectric ceramics

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Lead ceramics $Pb[(Zr_x, Ti_{(1-x)})_{0.9} (Cr_{1/5}, Nb_{1/5}, Sb_{3/5})_{0.1}]O_3$ with varying Zr/Ti ratio ($0.46 \leq x \leq 0.51$), prepared by conventional solid-state reaction method and their structure, electrical and piezoelectric properties were systematically investigated. X-ray diffraction analysis revealed that the morphotropic phase boundary (MPB) of PZT-PCNS ceramics located near ($0.47 \leq x \leq 0.49$), confirmed by their corresponding dielectric and piezoelectric properties. Scanning electron microscopy indicated that increasing x from 0.46 to 0.51 causes an increase in the grain size. The $Pb[(Zr_x, Ti_{(1-x)})_{0.9} (Cr_{1/5}, Nb_{1/5}, Sb_{3/5})_{0.1}]O_3$ ceramics show a homogeneous microstructure and excellent dielectric and piezoelectric properties. Specimens with optimum composition showed a piezoelectric charge constant d31 of 166pC/N, an electromechanical coupling factor kp of 0.5 and dielectric constant εr of 1591.32 at 1kHz.

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