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### Synthesis, Characterization and Performance of Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub>-ATP Composite Catalyst for Phenol Catalytic Oxidation

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**Keywords** [Catalytic Activity](#), [Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub>-ATP](#), [Co-Precipitation](#), [Nanocomposite](#)

**Abstract** Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub>-attapulgite (Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub>-ATP) nanocomposite materials were synthesized by co-precipitation method. The microstructure and phase composition of the as-prepared samples were characterized by X-ray diffraction (XRD), Laser Raman spectroscopy (LRS), energy-dispersive spectrometer (EDS) and transmission electron microscopy (TEM). The redox properties of samples were investigated by phenol oxidation experiment. The results indicated that La<sup>3+</sup> ions incorporated into CeO<sub>2</sub> lattice and formed solid solution. The Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub> particles with average size of about 10 nm were loaded onto the ATP and were widely dispersed. The catalytic activity was improved when La<sup>3+</sup> was introduced. The catalytic property of Ce<sub>0.8</sub>La<sub>0.2</sub>O<sub>1.9</sub>-ATP nanocomposites for phenol was better than that of CeO<sub>2</sub> and CeO<sub>2</sub>-ATP.

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### First page example

## Synthesis, Characterization and Performance of $Ce_{0.8}La_{0.2}O_{1.9}$ -ATP Composite Catalyst for Phenol Catalytic Oxidation

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**Keywords:**  $Ce_{0.8}La_{0.2}O_{1.9}$ -ATP; co-precipitation; nanocomposite; catalytic activity

**Abstract.**  $Ce_{0.8}La_{0.2}O_{1.9}$ -attapulgit ( $Ce_{0.8}La_{0.2}O_{1.9}$ -ATP) nanocomposite materials were synthesized by co-precipitation method. The microstructure and phase composition of the as-prepared samples were characterized by X-ray diffraction (XRD), Laser Raman spectroscopy (LRS), energy-dispersive spectrometer (EDS) and transmission electron microscopy (TEM). The redox properties of samples were investigated by phenol oxidation experiment. The results indicated that  $La^{3+}$  ions incorporated into  $CeO_2$  lattice and formed solid solution. The  $Ce_{0.8}La_{0.2}O_{1.9}$  particles with average size of about 10 nm were loaded onto the ATP and were widely dispersed. The catalytic activity was improved when  $La^{3+}$  was introduced. The catalytic property of  $Ce_{0.8}La_{0.2}O_{1.9}$ -ATP nanocomposites for phenol was better than that of  $CeO_2$  and  $CeO_2$ -ATP.

### Introduction

The phenolic compounds are used in many industrial processes as the raw materials nowadays, but they will pollute the water because they are highly toxic and barely biodegradable. As a result, there is an urgent need for efficient methods that can eliminate the phenolic compounds from industrial wastes and polluted groundwater. Many different processing methods have been used to cope with these toxic substances. Ozone oxidation is one of the advanced oxidation technologies, but its low efficiency, decomposition of the residual ozone and high cost make it difficult to use widely. Moreover, wet oxidation technologies are often operated at the high temperatures, high pressures and various aqueous systems [1]. Catalytic wet oxidation can overcome these aforementioned shortcomings by synergy between oxidation and catalysis of solid catalyst.  $CeO_2$  and  $CeO_2$ -based solid solutions have been extensively studied for catalytic application [2, 3]. The formation of solid solutions by doping foreign elements can improve the redox properties of  $CeO_2$ . Lanthanum oxide is an important basic material as catalyst and it is well known that lanthanum is used as doping element widely [4]. Some researches demonstrate that La doping in the  $CeO_2$  lattice to form the solid solution will make activity improve significantly [5, 6].

However, it is very hard to recover pure  $CeO_2$  or  $CeO_2$ -based oxides powders from water when they are used in aqueous systems. Coating the particles onto other materials is the promising method to resolve this problem. In the process of preparing the composite catalysts, the catalyst supports with abundant aperture structure and appropriate pore structure can strengthen the dispersion of active components, increase the surface of material and prevent the reunion of gains. And some supports can also provide reaction activity centers for catalytic oxidation reactions, which generate synergy between with the active components. Several kinds of supports, such as silica and  $\gamma-Al_2O_3$ , have been used to prepare the  $CeO_2$ -based catalysts [7, 8]. But, the supports, which are synthesized by chemical reactions, have inherent defects, such as expensive cost, long time consuming and lower surface area. ATP clay has been used as catalyst support widely because of its unique porous crystalline structure, microfibrillar morphology, cheapness and considerable textural property [9].

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