انجمن مهندسی شیمی ایران

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دانشگاه صنعتی شریف

بسمه تعالی

بدین وسیله گواهی می گردد، مقاله تحت عنوان

Hydrothermal Synthesis of ZnO Nanosheets Using Molybdophosphoric Acid as a Green and Eco-friendly Catalyst

به تحریر نویسندگان

Hamed Rashidi , Ali Ahmadpour, Fatemeh F. Bamoharram ,Seyyed Mojtaba Zebarjad , Majid M. Heravi ,Ali Ayati

در چهاردهمین کنگره ملی مهندسی شیمی ایران، ۲۵ الی ۲۷ مهرماه ۱۳۹۱، دانشگاه صنعتی شریف، مورد پذیرش قرار گرفته و ارائه گردیده است.

احمد رمضانی سعادت آبادی

دبیر کنگره

چـهاردهمـــین کنگره ملـــی مهندسی شیمی ایـــران
دانشگاه صنعتی شریف
14th Iranian National Congress of Chemical Engineering
Sharif University Of Technology

فنـــاوری نانـــو - ۱۰
Nanotechnology

Effect of Precursor on Physicochemical Properties and Catalytic Performance of Ni-Co over Mixed Nano-oxides of Al-Mg-Zr Used in Dry Reforming of CH_4

Seyed Mehdi Sajjadi[1,2], Mohammad Haghighi*[1,2], Farhad Rahmani[1,2]

کد مقاله: ۱۰۲۳۱

Abstract

Ni-Co over mixed nano-oxides of Al-Mg-Zr have been synthesized by sol–gel technique with two different precursors of zirconia i.e. zirconyl nitrate hydrate (ZNH) and zirconyl nitrate solution, 35 wt% solution dilute nitric acid (ZNS) and used in dry reforming of methane. Both nanocatalysts have been characterized by XRD and FESEM analysis. Comparing XRD patterns of synthesized samples revealed that nanocatalyst employed ZNS (NCZNS) has a suitable crystalline structure which improves catalytic activity. In contrast, the amorphous behavior was intensified in the other one which used ZNH (NCZNH). FESEM results of NCZNS indicated uniform, homogeneous and well dispersed particle size. The synthesized nanocatalysts showed high catalytic activity and stability during 1440 min. It was observed that NCZNS has better catalytic performance. The results confirmed the remarkable effect of zirconia precursor on the sample morphology, structure and catalytic activity.

Functionalized magnetic nano-particles for determination and removal of heavy metal ions in environmental samples

کد مقاله: ۱۰۲۳۵

Nader Dizadji[1], *Ghazaleh Armaghan[2], Omid Sadeghi[3], Dariush Bastani[4]

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In this work Fe_3O_4 nano-particles have been synthesized by co-precipitation method. This nano-particles have been functionalized by amine group using 3-Amino propyl triethoxy silane and characterized by X-ray powder diffraction (XRD), infrared (IR) spectroscopy, scanning electron microscopy (SEM), thermal (TGA-DSC) and elemental analyses. Application of these magnetic nano-particles was investigated in heavy metal determination and removal. Effects of several parameters such as the sample pH, eluent type and concentration and also maximum adsorption capacity of functionalized mesoporous in removal and determination of heavy metals have been studied.

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- Novel synthesis of ZnO nanosheets using Heteropolyoxomatalates.
- Using new catalytic approach for synthesis of ZnO nanosheets.
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1. Introduction

ZnO nanoparticles (NPs) are promising materials to use as catalysts for photo-catalytic degradation [1], gas sensors [2] and catalysts for liquid phase hydrogenation [3]. Therefore, investigations on the synthesis of nanosized and nanostructured ZnO have attracted great attentions.

Different synthesis methods for preparation of ZnO nanostructures have been used including sol- gel technique [4], spray pyrolysis [5] and hydrothermal processing [6]. Controlling the particle shape and size is one main concern for nanostructured material synthesis, because both electrical and optical properties of nanomaterials depend on both size and shape of the particles.

In the past few years, POMs were applied to the morphology-controlled fabrication of nanostructures and has attracted more and more remarkable attentions in the synthesis of nanomaterials [7]. Polyoxometalates (POMs) are a class of inorganic metal-oxygen cluster compounds with unique molecular structure, chemical characters and electronic versatility [8].

In this article, the authors wish to report the results for the synthesis of ZnO nanosheets hydrothermally, using HPMo as a catalyst. The results suggested that HPMo is a useful catalyst for this reason. Also, photocatalytic activity of nanosheet products is examined with photocatalytic degradation of methylene blue (MB) as one of the most important azo dye and kinetic of reaction was also studied. The major aim described in this work is the design and development of applications for HPMo as a green and eco-friendly catalyst, which is a very important member of keggin type heteropoly acids.

2. Experimental

2.1. Synthesis methodology

Zinc acetate dihydrate, Ethanol (analytical grade) and molybdophosphoric acid (HPMo) were purchased from Merck Company. In a typical experiment, 1 g of Zinc acetate dehydrate was added into 30–40 mL solution of 3×10^{-3} M of HPMo in ethanol under magnetic stirring. After stirring for a few minutes, the mixture was transferred into a 50 mL Teflon-lined stainless steel autoclave, maintained at 120 °C for 48 hr and then cooled to room temperature naturally. The white precipitates were separated by centrifugation, washed several times with distilled water and ethanol, respectively and then dried at 60°C for 8 hr to get a white fine powder. The powder was used for further characterization and for photodegradation of azo dyes.

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FT-IR spectra were obtained with a Bruker 500 scientific spectrometer (KBr powder). The crystal structure of the prepared ZnO nanostructures were characterized by X-ray diffraction (XRD) (Bruker D8 Advance) using Cu-Kα radiation (λ=1.5406 Å). The morphology and size of ZnO nanosheets were determined by transmission electron microscope (TEM, PHILIPS CM-120) with an acceleration voltage of 120 kV.

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For photocatalytic degradation, the prepared ZnO nanosheets (0.1 g) were dispersed into 25 mL of 3.2×10^{-5} M of MB aqueous solution and then obtained suspension was stirred at dark for 30 min for equilibrium between adsorption-desorption of MB on the surface of nanosheets. Then, the suspension was transferred into the photoreactor in which oxygen was bubbling continuously from the bottom of the reactor. The suspension was then exposed to a

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In this study, ZnO nanosheets were synthesized be hydrothermal method. The ZnO nanosheets were synthesized by the reaction of $Zn(CH_3COO)_2$ and ethanol in the presence of HPMo as excellent catalyst under hydrothermal conditions. The chemical equations can be expressed as follows [9]:

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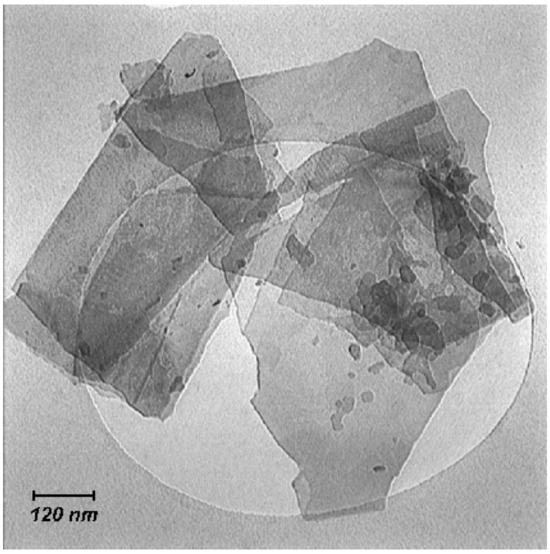
Figure 1 shows a TEM image of the ZnO nanosheets formed at 120˚C after 48 hr hydrothermal synthesis process.



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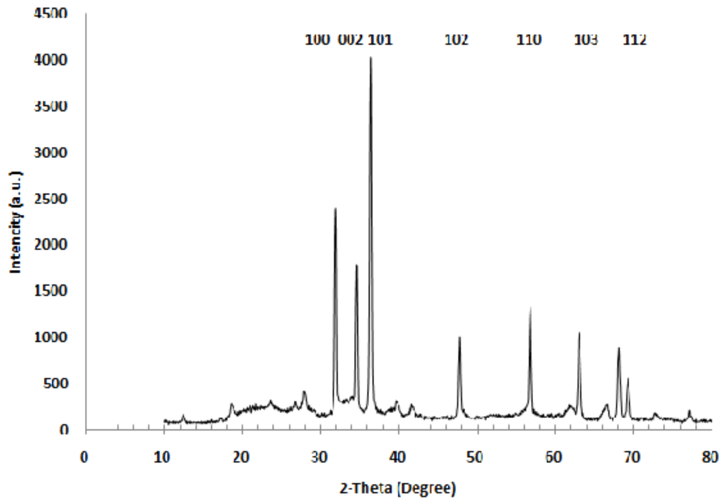
It is seen in Fig. 1 that a large amounts of ultra thin ZnO nanosheets were synthesized after 48 hr. Also, Fig. 2 shows the typical X-ray diffraction (XRD) pattern of these ZnO nanostructures.



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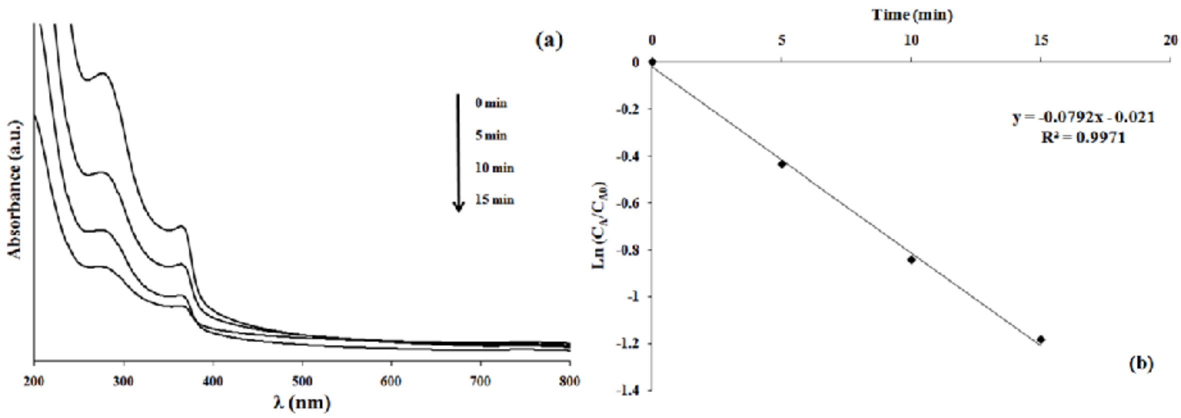

Fig. 3. Photocatalytic degradation of methylene Blue, (a) UV absorption spectra, (b) Kinetic study of degradation reaction for MB.

The rate of decolorization was recorded with respect to the change in the intensity of absorption peak in the visible region. The prominent peak was decreased gradually indicating that the dye has been degraded. Almost 70% decolorization was observed when experiments were carried out under UV light in the presence of ZnO nanosheets for 15 min.

Fig. 3b shows the kinetic of degradation of MB. The results show that the photocatalytic decolorization of MB in aqueous ZnO solutions can be described by the first-order kinetic model, $Ln(C_A/C_{A0}) = kt$, where C_{A0} and C_A are initial and final concentrations, respectively. The semi-logarithmic plots of the concentration data gave straight lines showing the first order kinetics of the reactions. The correlation constants (R^2) of the fitted lines is 0.9971. The rate constants was also estimated to be 0.0792 min^{-1}.

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ZnO nanosheets were successfully synthesized by hydrothermal method using zinc acetate dihydrate and ethanol in the presence of molybdophosphoric acid (HPMo) as a catalyst. The results of XRD demonstrated that the synthesized products are single crystalline with zinccite phase. The experimental results indicated that the ZnO nanosheets are good photocatalysts for decolorization of MB. The photocatalytic decolorization followed first order kinetic with constant rate of 0.0792 min^{-1}.

References:

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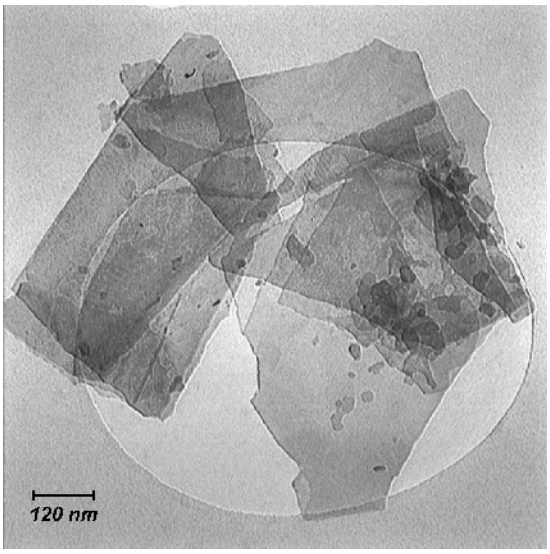

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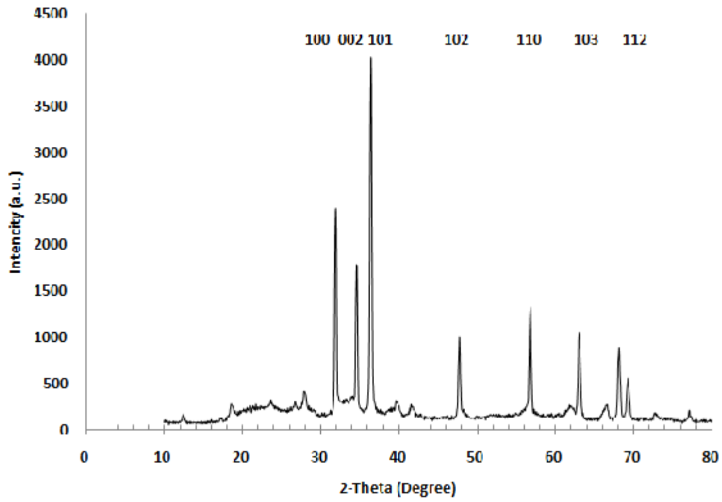

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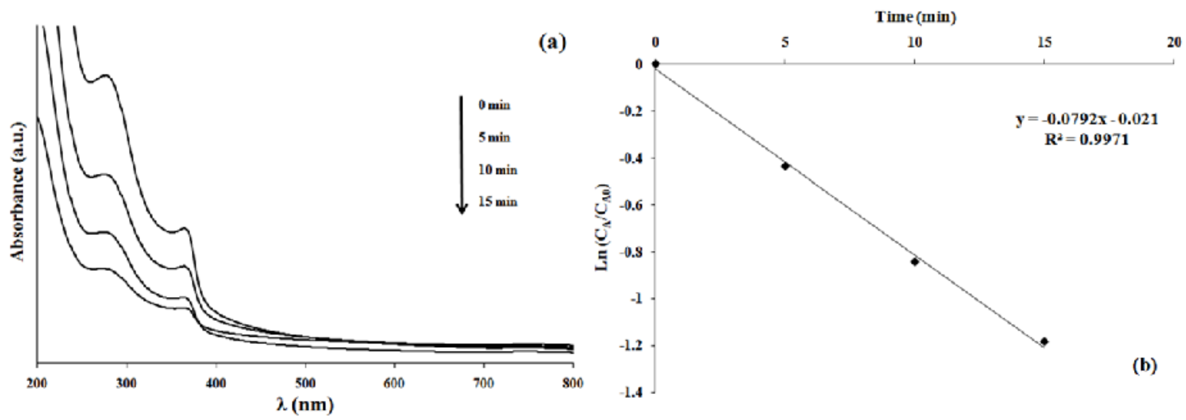

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