Research Article

Chemical Review and Letters
journal homepage: www.chemrevlett.com
ISSN (online): 2645-4947

Crystal structure and luminescence properties of a new nanostructure lead(II) complex: a precursor for preparation of pure phase nanosized PbO

Ezzatollah Najafi [a,*], Farnaz Behmagham[b], Niloofar Shaabani [a], Nasrin Shojaei [a]

[a]*Department of Chemistry, Payame Noor University, PO Box 19395-3697 Tehran, Iran*
[b]*Department of Chemistry, Miyandoab Branch, Islamic Azad University, Miyandoab, Iran*

ARTICLE INFO

Article history:
Received
Received in revised form
Accepted
Available online

Keywords:
Coordination polymer
Nanosize lead complex
Photoluminescence
Lead(II) oxide

ABSTRACT

The reaction of 1,3-diphenylpropane-1,3-dione (HL) ligand with lead(II) nitrate under hydrothermal conditions led to the formation of a novel lead complex with singular structural features. The characterization of title complex was performed by spectroscopy methods such as ^{1}H NMR, UV, and IR and elemental analyses (CHN) and crystal structure of prepared lead (II) complex was determined by single-crystal X-ray diffraction. The facile and productive sonochemical method was used to prepare nano-size particles of the title complex at room temperature. The prepared nano-size-complex was characterized by elemental analysis, scanning electron microscopy (SEM), IR spectroscopy and X-ray powder diffraction (XRD). The nano-size lead oxides that prepared by calcination of the nano-size complex and crystalline bulk complex showed the initial particle size of the precursor is influential on the particle size of the derived PbO nanoparticles. Optical property investigation of the PbO nanoparticles at room temperature showed that the size of PbO nanoparticles has an important role on their optical behavior.

1. Introduction

During the last two decades, pronounced interest has been devoted to the preparation of novel metal coordination compounds with multi-dimensional networks, which involves a self-assembly of organic multitopic ligands with suitable functional groups and metallic centers. Concomitantly, this interest also is due to the unique structural topologies and potential applications in many fields, such as lasers, telecommunication technology, transistors and optical sensors for very particular probes and in bioanalysis (Zhou et al., 2016; Sreejith et al., 2016; Małecki et al., 2017; Fard et al., 2017; Suckert et al., 2017). Investigation of the molecular structures of a large number of coordination compounds of main and transition metal ions exhibited that the selection of an appropriate ligand and the knowledge of the nature and number of the binding modes and binding geometry of it is one of the most important tasks to improve the molecular recognition ability of coordination compounds. A change in length, symmetry and flexibility of organic ligands provides serviceable conditions for making new classes of compounds with distinctive arrangement and applications (Ngoune et al., 2016; Im et al., 2016; Fereshteh et al., 2016; Lee et al., 2016; Savchenkov et al., 2017). It seems potential utilization of nano-metal–organic coordination compounds is necessary for nano-technological applications. Nevertheless, preparation and investigation of their properties have not yet been comprehensively scrutinized (Aboutorabi et al., 2016; Ghasempour et al., 2015; Karizi et al., 2015; Lin et al., 2017; Rabou et al., 2017; Kruszynski et al., 2017). The chemical and physical properties of materials strongly rely on their size and shape. Nano-materials completely have different properties and behavior than their bulk particles form because of their small size and large surface-to-volume ratios (Rostamnia et al., 2014; Esfanjani et al., 2016; Sumesh et al., 2017; Li et al., 2017; Ding et al., 2017). Therefore, developing nano-metal–organic coordination polymers in any mold with remarkable properties should be very important and beneficial for the future success of science and technology in the nanoscale field. For the first time, Wang reported preparation of non-coordination polymers and by this time, several distinctive synthetic methods have been suggested for the preparation of

* Corresponding author. e-mail: ezzat.najafi@gmail.com