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Synthesis of $ZnSnO_3$ cubic crystallites at room temperature

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ABSTRACT

The work presented in this report is aimed to synthesize Nanocrystalline Zinc Stannate powder. The general objective was to synthesize crystalline zinc Stannate ($ZnSnO_3$) Cubic crystallites by employing a simple chemical route. In this work, the zinc Stannate Cubic Crystallites (length 1-1.2 m) were successfully synthesized at low cost by using simple chemical method the experimental result demonstrated a low cost, simple, rapid and suitable simple chemical method for the synthesis of $ZnSnO_3$ cubic crystallite This topic discusses the simple chemical route for the synthesis $ZnSnO_3$ Cubic Crystallites, its importance and finally it concludes with the objectives of the present work.

Keywords— *$ZnSnO_3$, XRD, FE-SEM, FTIR, Crystalline*

1. OBJECTIVES

(a) To synthesize the $ZnSnO_3$ microcubes by simple chemical method
(b) To characterize the synthesized $ZnSnO_3$ microcubes by XRD, FE-SEM and FTIR

2. ZINC STANNITE

This formulation is available in the form of a white crystalline powder the compound is only slightly soluble in water but is freely soluble in alcohol and in methanol we ensure that the product supplied by is of the outmost quality and is in accordance with international quality regulation we have in store for our clients a wide range of Zinc Stannate ($ZnSnO_3$) manufactured in our state of the manufacturing unit, this is Quality tested on well define parameters before supplying it to our clients. Below mention is some of the packaging specifications.

3. SHIPPING PACKING

Not classified as dangerous in the meaning of transport regulation packing. 25 Kg polythene lined packages supplied meet with UN performance standard where appropriate special packaging requirements can be accommodated.

3.1 Specification

Technical data sheet

Molecular weight- 232.15
Description- white powder

3.2 Properties

Tin: 53.00 to 56.00 %
Zinc: 26.0 to 27.5 %
Chloride - 800 ppm max Moisture: 0.5 %
Volatile loss at 105^0c: 1.00% max
Conductivity U.S. 800 max
Decomposition temperature: > 570^0c

3.3 Uses

Halogen synergist fire retardants and smoke Suppressants for a wide range of polymers applications.

3.4 Advantages

(a) Outstanding suppression combined with flame retardancy.
(b) Dual-phase action
(c) Not toxic.
(d) Lower heat release rates, Narrow grain size distribution.

3.5 Application

(a) Polymer additive
(b) Strategic process chemicals
(c) Pharmaceutical preparation and micronutrients
(d) Pharmaceutical and synthetic intermediates
(e) Flame retardants
(f) Silk screen printing
(g) Polymer stabilizers
(h) Glass
(i) Plating
(j) Water treatment
(k) Plating of electronic components
(l) Pigments

4. SIMPLE CHEMICAL METHOD

Formaldehyde (HCHO) vapour is closely connected to public health and safety, and it is a colourless, strong-smelling, and well-known carcinogen often used in the workplace and comes from the adhesive used in the manufacture of resins, plastics, coatings, and fabrics.1 HCHO injures the eyes, nose, and respiratory organs and causes allergies, which is called sick house syndrome at low levels1 and may cause death at concentrations higher than 15 ppm. 2 There are some conventional methods to detect HCHO in the laboratory and industry, such as colorimetry, 3 polarography, 4 chromatography, 5 spectroscopy, 6, 7 and fluorescence. 8, 9 However, they usually need large equipment and long detection time. Rapid, facile, and accurate detection of form- aldehyde vapor is especially important from the practical point of view. Semiconducting metal oxides, for instance, SnO_2, 10-14 polyhedral Zinc Stannate ($ZnSnO_3$), 2 $CdIn_2O_4$ nanoparticles, 15 vanadium pentoxide nanobelts, and 16 and so on, have been extensively investigated and used for gas detection because of their sensitivities for different gaseous species. 17, 18 the gas-sensing process of metal oxide sensors generally involves a catalytic reaction between the gas to be monitored and the adsorbed oxygen on the surface of the sensor. The particle size, defects, surface, and interface properties of metal oxide sensors directly affect the state and the amount of oxygen species on the surface of the sensors and consequently the performance of sensors. Among these factors, high surface area and lesser particle size of semiconducting metal oxide is particularly advantageous for evidently enhancing the sensing performance.19-21. The preparation method for sensing material therefore plays an important role in tailoring the morphological characteristics and control over the particle size and surface area of the sensor. Classical aqueous sol-gel techniques have been widely applied for the synthesis of metal oxide nanoparticles, because they offer several advantages over the high-temperature solid-state methods, such as high purity and homogeneity and low.

- Zinc Stannate ($ZnSnO_3$)
- $ZnSnO_3$ (Zinc Stannate)
- n-type semiconductor
- $ZnSnO_3$ nanoparticles
- Potential applications: Polymer Stabilizers, Water Treatment, Pigments, gas sensors etc. Synthesis methods- hydrothermal, a thermal evaporation method, co-precipitations, etc.

The $ZnSnO_3$ cubic crystallites successfully synthesized at a low cost by using a simple chemical method.

5. MATERIALS

All chemicals were of analytical grade. Zinc sulphate heptahydrate ($ZnSnO_4$) and Sodium Stannate try hydrate (Na_2SnO_3)

Experimental procedure

$ZnSO_4.7H_2O$ (10 mM) | $Na_2SnO_3 .3H_2O$ (10 mM)

Double distilled water as a carrier

Stir the solution and keep stirring at temperature 30 °C for 5 h

White colored precipitate

Filter the precipitate, wash with D.D. H_2O and dry at 100 °C in vacuum for 24 hr

Fig. 1: Experimental procedure

6. XRD PATTERN

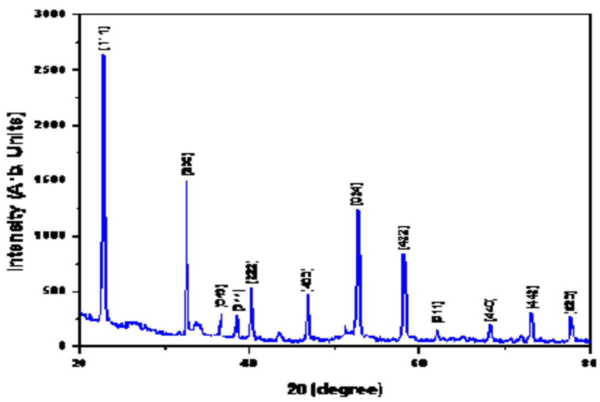

Fig. 2: XRD pattern

- XRD result revels the formation of $ZnSnO_3$ cubic crystallites with the perovskite structure. (JCPDS # 11-0274). No diffraction peaks due other impurities were detected.
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7. TEM RESULT

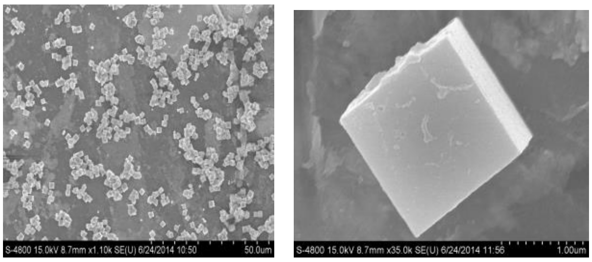

Fig. 3: TEM result

- Composed of large-scale uniform and monodisperse cubic crystallites uniform morphology and narrow size distribution of the nanoparticles.
- Reveals the formation of microcubes with an average edge length of about 1-1.2 µm.
- shows a clear surface with no aggregation

8. CONCLUSION

- The $ZnSnO_3$ cubic crystallites successfully synthesized at a low cost by using a simple chemical method.
- The XRD results reveal the formation of $ZnSnO_3$ cubic crystallites with the perovskite structure.
- The FE-SEM results show the microcubes with an average edge length of about 1-1.2 µm
- The experimental results demonstrated a low cost, simple, rapid and suitable simple chemical method for the synthesis of $ZnSnO_3$.

9. RESULTS AND DISCUSSIONS

This chapter presents the results of studies and characterization of $ZnSnO_3$ nanoparticles by Simple chemical rout. The synthesized $ZnSnO_3$ nanoparticles were characterized by XRD, FESEM. The experimental result demonstrated that simple chemical rout is a low cost, simple and suitable method to synthesize $ZnSnO_3$ nanoparticles.

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