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# Synthesis of nickel and cobalt sulfide nanoparticles using a low cost sonochemical method

Matjaž Kristl<sup>a,\*</sup>, Brina Dojer<sup>b</sup>, Sašo Gyergyek<sup>c</sup>, Janja Kristl<sup>d</sup>

<sup>a</sup> Faculty of Chemistry and Chemical Engineering, University of Maribor, Slemenova 17, SI – 2000, Maribor, Slovenia

<sup>b</sup> Faculty of Natural Sciences and Mathematics, University of Maribor, Koroška cesta 100, SI – 2000, Maribor, Slovenia

<sup>c</sup> Jozef Stefan Institute, Department for Materials Synthesis, Jamna cesta 39, SI – 1000, Ljubljana, Slovenia

<sup>d</sup> Faculty of Agriculture and Life Sciences, University of Maribor, Pirnika 80, SI – 2311, Muta, Slovenia

\* Corresponding author.

E-mail address: matjaz.kristl@um.si (M. Kristl).

## Abstract

Nickel and cobalt sulfides are promising materials in different cutting-edge research areas like solar cells, supercapacitors, catalysts, and electrode materials. Nickel and cobalt sulfides with various stoichiometries have been synthesized sonochemically from  $\text{Ni}(\text{CH}_3\text{COO})_2 \cdot 4\text{H}_2\text{O}$ ,  $\text{Co}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$  and different sulfur precursors using a direct immersion ultrasonic probe. The products were characterized by X-ray powder diffraction, transmission electron microscopy (TEM) including EDX analysis, IR and UV–Vis spectroscopy and elemental analysis. Following products have been obtained:  $\text{NiS}$ ,  $\text{Ni}_2\text{S}_3$ ,  $\text{CoS}_{1.092}$  and  $\text{Co}_9\text{S}_8$ , with average crystallite sizes in the range 7–30 nm. Effects of different reaction conditions on the size, morphology and optical band-gap energy were evaluated. Optical band-gap energies in the range 3.3 eV–3.8 eV were observed for the obtained nanoparticles.

**Keywords:** Materials science, Inorganic chemistry, Nanotechnology

## 1. Introduction

Transition metal chalcogenides have attracted considerable attention during the past decade due to their unique physical and chemical properties, including their

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## **Table of Contents Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using**

1. Understanding the eBook Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - The Rise of Digital Reading Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Advantages of eBooks Over Traditional Books
2. Identifying Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in a Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - User-Friendly Interface
4. Exploring eBook Recommendations from Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Personalized Recommendations
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using User Reviews and Ratings
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using and Bestseller Lists
5. Accessing Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using Free and Paid eBooks
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using Public Domain eBooks
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using eBook Subscription Services
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using Budget-Friendly Options

6. Navigating Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using eBook Formats
  - ePub, PDF, MOBI, and More
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using Compatibility with Devices
  - Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Highlighting and Note-Taking Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Interactive Elements Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
8. Staying Engaged with Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
9. Balancing eBooks and Physical Books Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Setting Reading Goals Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Fact-Checking eBook Content of Synthesis Of Nickel And Cobalt Sulfide Nanoparticles Using
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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