CHEM F376

UNDER THE GUIDANCE OF R.N. PANDA

Design Oriented Project

On Synthesizing shape selective nickel Nano-crystals

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OBJECTIVES

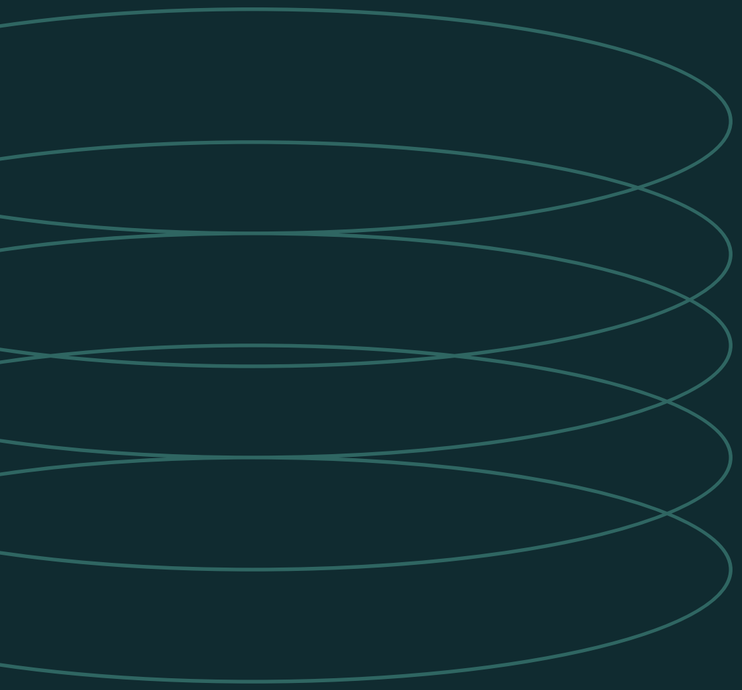
Understanding Nickel Nanocrystals

- Abstract
- Introduction to Nanoparticles
- Properties of Nickel
- Shape Selective Synthesis
- Experimental
  - Synthesis
  - Heat Treatment
  - X-ray Diffraction
  - FESEM
- Applications
- Learning Outcomes
- References

Abstract

Shape Selective Synthesis of spherically shaped nickel (Ni) nanocrystals have been carried out by reducing Nickel (II) chloride hexahydrate and with sodium borohydride in the presence of PEG 200 as an organic modifier. The organic modifiers play an essential role in deciding the size and structure of the nickel nanoparticles. The as-prepared nanostructured Ni samples have been characterised by powder X-ray diffraction (XRD) and Field emission scanning electron microscopy (FESEM)

Introduction to Nanoparticles



Nanocrystals are aggregates of atoms that combine into a “cluster” and are less than 1 μm in size. Typical sizes range between 10 and 400 nm. Their physical and chemical properties are observed somewhere between that of bulk solids and molecules. As the size gets reduced its effective surface area increases, which will ultimately increase the solubility and bioavailability.

Shape Selective Synthesis

Shape-selective synthesis of a nanoparticle is the process of synthesizing the given nanoparticle in a specific way so as to yield a given shape

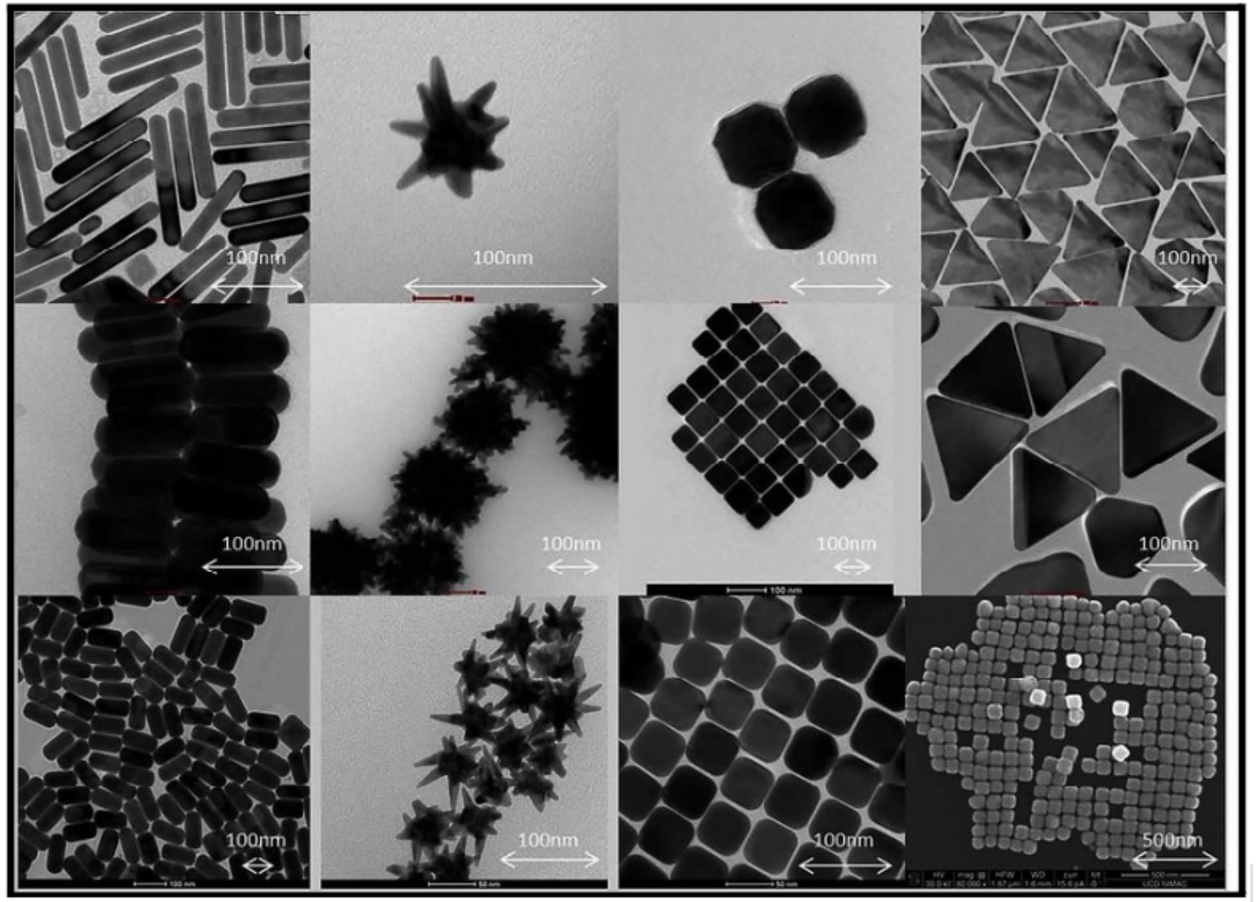
TYPES OF SHAPES

Recently a variety of novel shapes such as quantum dots, nanorods, nanoribbons, nanowires, nanotubes, and hollow spheres have been synthesized through varied synthetic reactions at room or slightly elevated temperatures.

FOCUS FOR THE PROJECT

- Shape selective synthesis of spherical-shaped Nickel nanocrystals

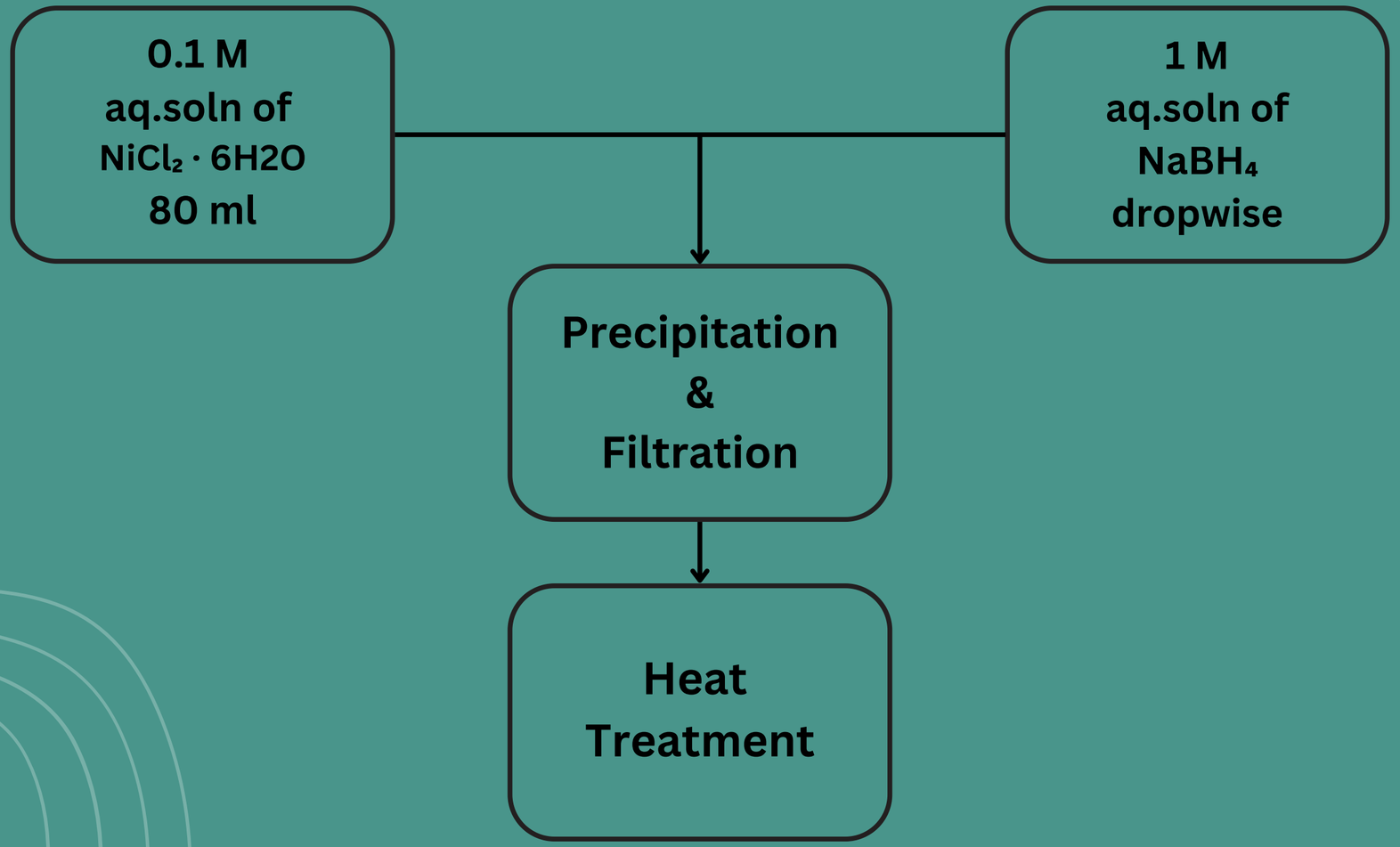
Shape Selective Synthesis



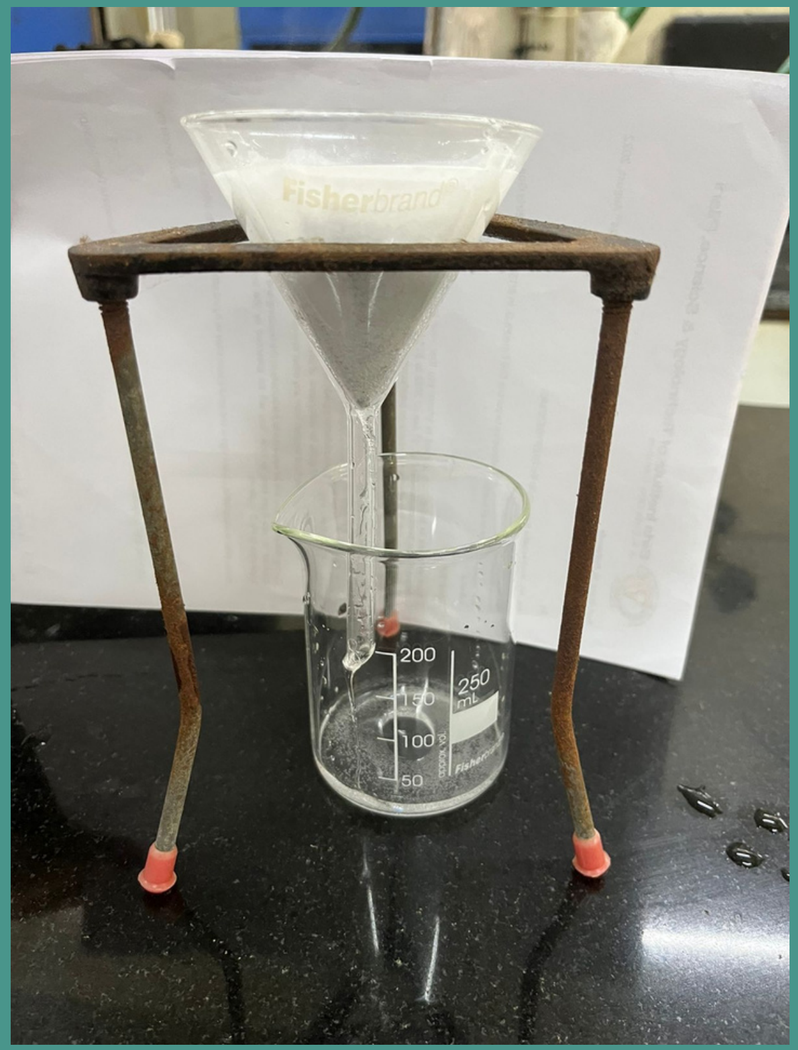
Different shapes of Nanoparticles

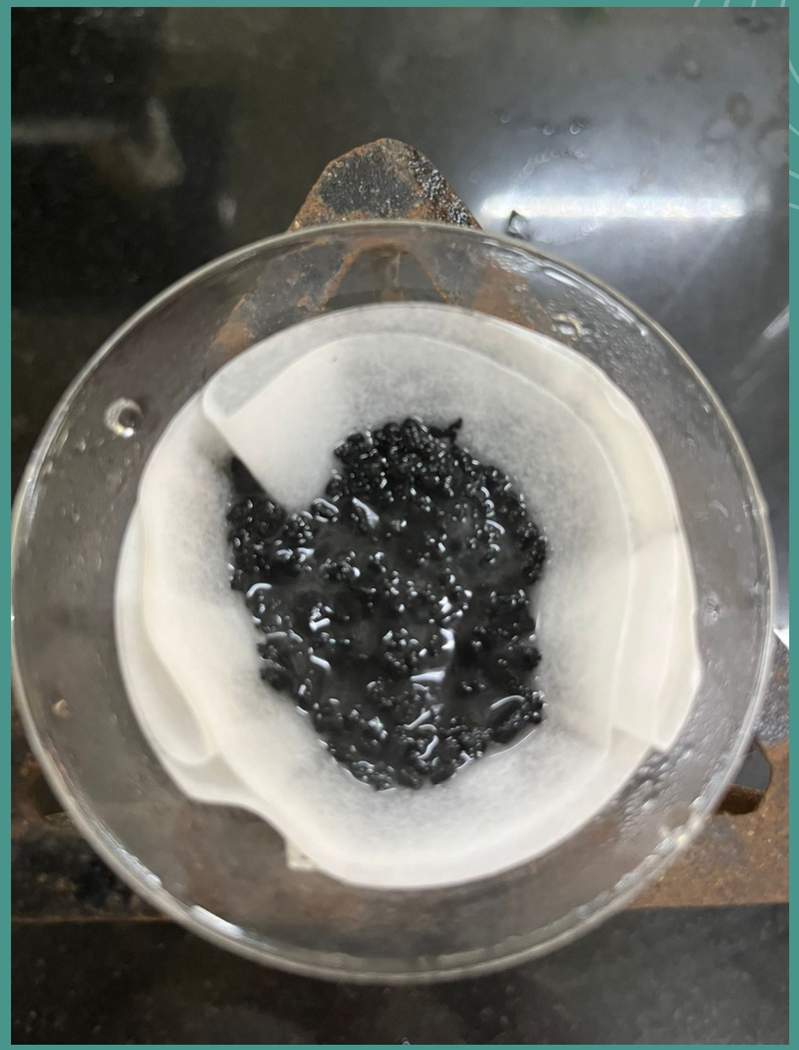

Experimental

SYNTHESIS PROCEDURE



SYNTHESIS PROCEDURE

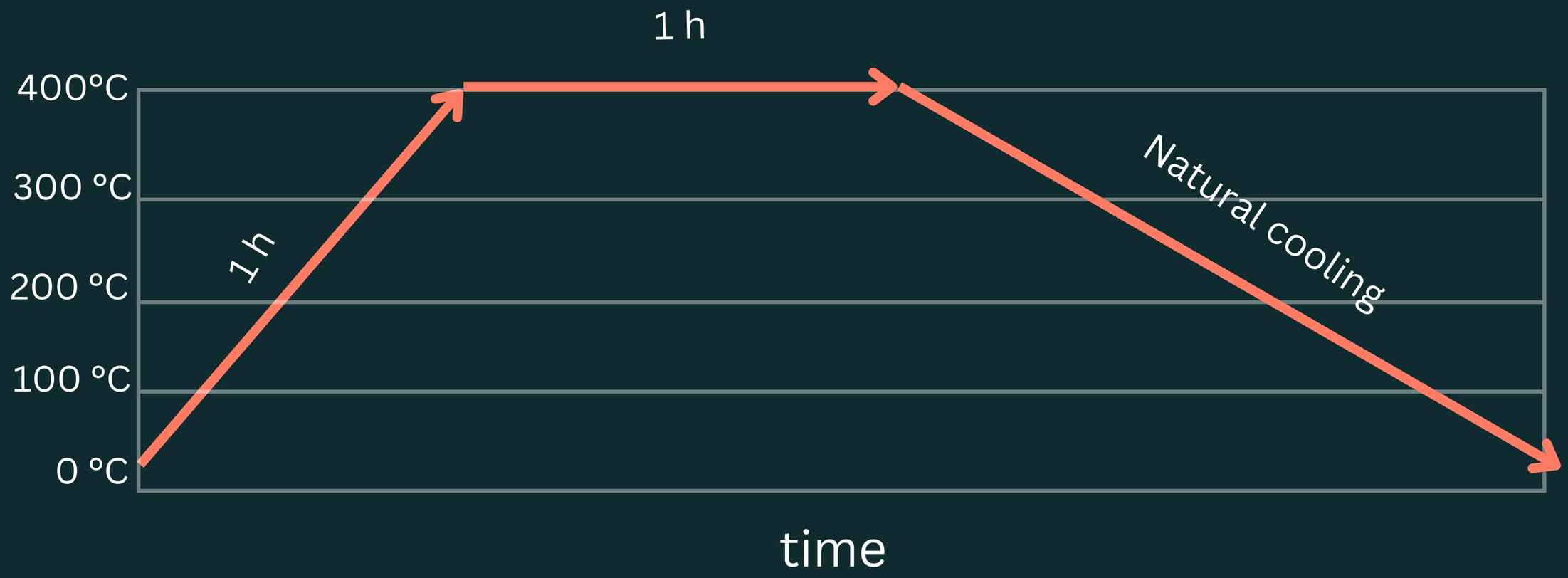




Heat Treatment

Heat treatment carried out in furnace

Heat under N_2 gas flow for 3 to 4 hrs
To study the effect of temperature the sample would be heated at two different temperatures i.e. 400 °C and 500 °C

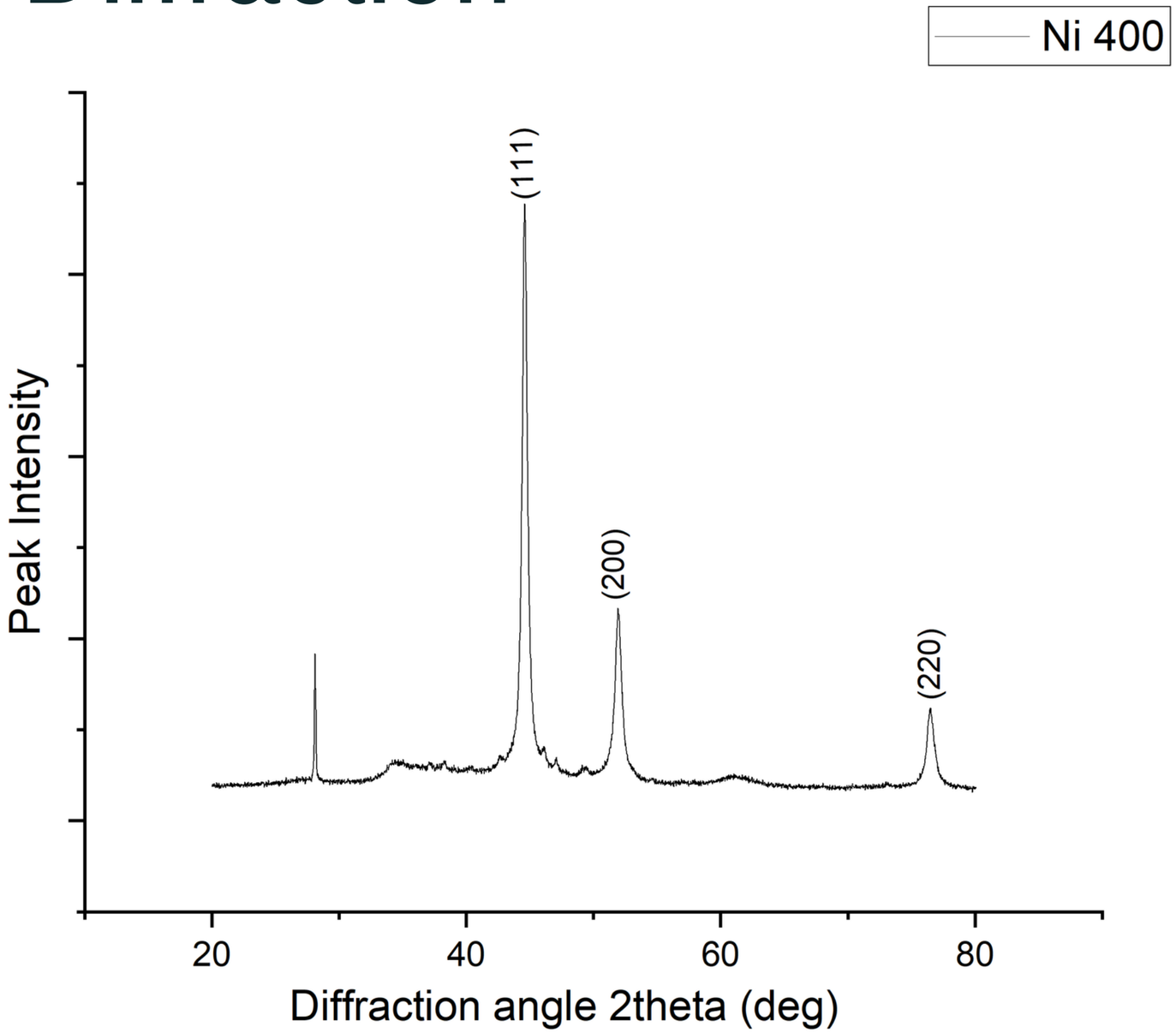


X-Ray Diffraction

- X-ray diffraction (XRD) is used for the primary characterization of material properties like crystal structure, crystallite size, and strain.
- XRD works on the principle of Bragg’s equation

$$2d\sin\theta = n\lambda$$

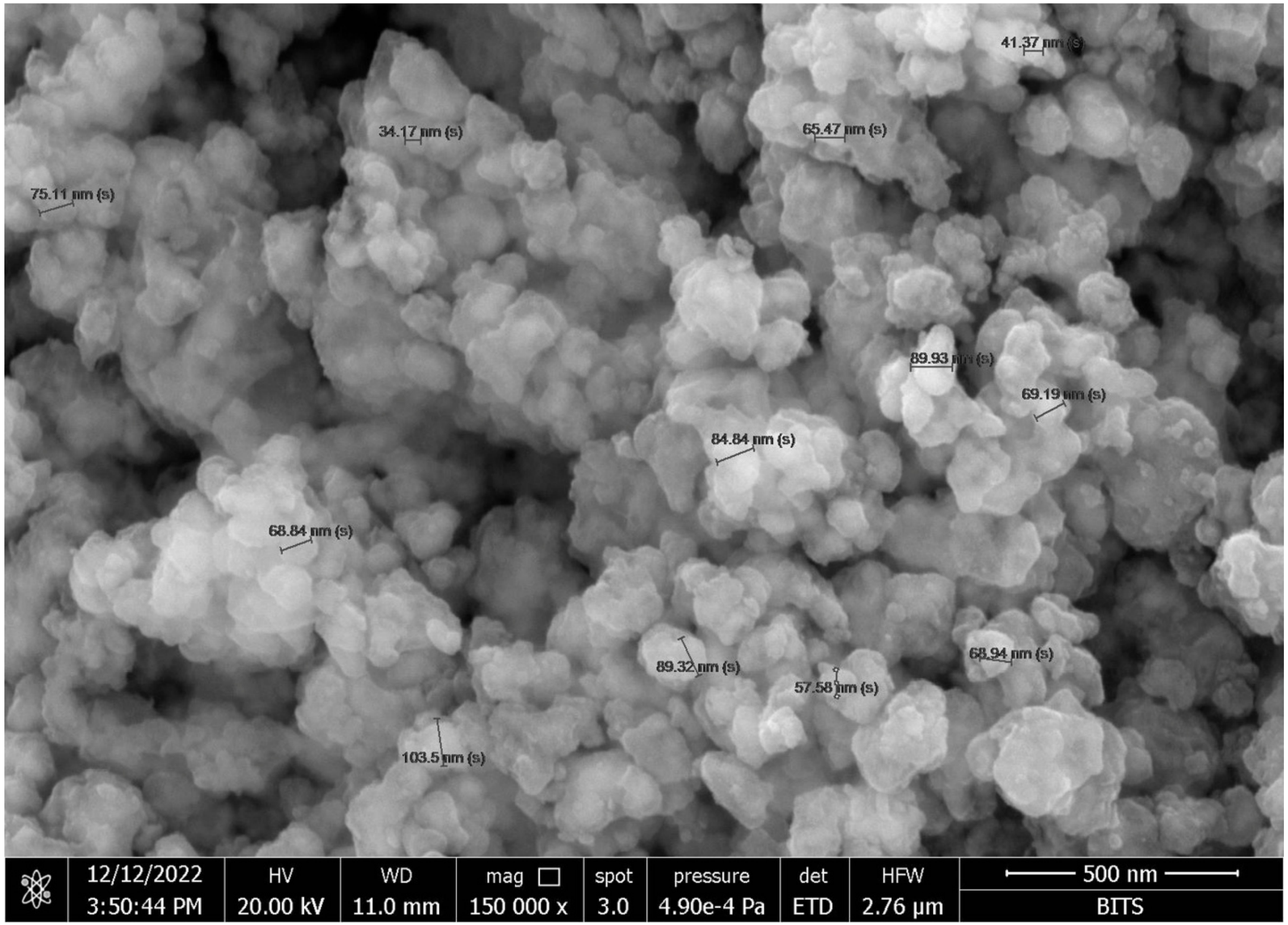
X-Ray Diffraction



X-Ray Diffraction

Peak No	2Θ (deg)	Θ (deg)	Θ (radian)	sinΘ	2sinΘ	nλ (Å)	d=nλ/ 2SinΘ
111	44.5	22.25	0.39	0.38	0.76	1.54056	2.03
200	51.9	25.95	0.45	0.43	0.86	1.54056	1.79
220	76.5	38.25	0.67	0.62	1.24	1.54056	1.24

FESEM


41.37 nm (s)
34.17 nm (s)
65.47 nm (s)
75.11 nm (s)
89.93 nm (s)
69.19 nm (s)
84.84 nm (s)
68.84 nm (s)
89.32 nm (s)
68.94 nm (s)
57.58 nm (s)
103.5 nm (s)
12/12/2022
3:50:44 PM
HV
20.00 kV
WD
11.0 mm
mag
150 000 x
spot
3.0
pressure
4.90e-4 Pa
det
ETD
HFW
2.76 µm
500 nm
BITS

APPLICATIONS OF NICKEL NANOPARTICLES

- Biomedical applications of Ni nanoparticles
- Application of Ni nanoparticles in superconductors and enhancement of materials
- Application of Ni nanoparticles in dye-sensitized solar cells and sensors

Learning Outcomes

- Learning about synthesis and various lab equiptments
- XRD Analysis
- FESEM Analysis
- Heat Treatment in Nitrogen Atmosphere
- Analysis of the graphs,yieds and effects of organic modifiers

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Thank You