International Journal of Applied Research 2020; 6(3): 356-359


**ISSN Print:** 2394-7500
**ISSN Online:** 2394-5869
**Impact Factor:** 5.2
IJAR 2020; 6(3): 356-359
www.allresearchjournal.com
Received: 09-01-2020
Accepted: 15-02-2020

**Sangeetha S**
PG Scholar, Department of Chemistry, Kailash Women's College, Nangavalli, Tami Nadu, India

**Mohanapriya S**
Department of Chemistry, Kailash Women's College, Nangavalli, Tami Nadu, India

**Shanmugavalli M**
Department of Chemistry, Kailash Women's College, Nangavalli, Tami Nadu, India

**Correspondence Authors:**
**Mohanapriya S**
Department of Chemistry, Kailash Women's College, Nangavalli, Tami Nadu, India

# Synthesis and characterization of $VS_2$ nanoparticles by Sol-Gel method

**Sangeetha S, Mohanapriya S and Shanmugavalli M**

**Abstract**
Simple chemical methods sol-gel method is employed to form nanoparticles of vanadium sulphide ($VS_2$) using $NH_4OH$ and thiourea solution as source materials. Citric acid was used as fuel in sol-gel method. The characterization of the products was done by Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), Energy Dispersive X-ray Analysis (EDX) and Ultraviolet-Visible (UV-Vis) absorption. The characterization of the samples observed by SEM, FTIR, EDX and UV-Vis spectrometer shows that formation of $VS_2$ nanoparticle.

**Keywords:** Nanoparticle, Sol-gel method, Vanadium sulphide

## 1. Introduction
Sol-gel process have been comprehensively explored for conveying metal oxide nanostructures in the field of building and creative applications in all likelihood in view of the controlled shape and size showed by the got things. Since the association of silica gel by Ebelman in 1846, this system has been developed progressively and sol-gel consolidated materials have been realized in a couple of utilizations with brilliant optical, appealing, electrical, warm and mechanical properties [1]. A couple of kinds of materials, for instance, thin films, nanoparticles, glass and stoneware can be practiced using sol-gel system in a smart manner [2]. Low temperature science, reproducibility and high surface to volume extent of procured things are various features that add authenticity to this advancement [3]. Beside this, sol-gel process have opened up some new streets in bioengineering fields including drug transport, organ implantation, pharmaceuticals and biomaterial mix in view of the ethicalness and nature of the yields from this methodology. These inclinations have pulled in researchers and industrialists to utilize this methodology comprehensively for ongoing decades [4]. Metal oxides are class of utilitarian materials with different applications and can be joined using sol-gel process [5]. Sol-gel association of metal oxide should be conceivable at decently low temperature appeared differently in relation to the solid state reactions. All things considered, sol-gel process incorporates improvement of sol from homogeneously mixed course of action, changing over them into gel by polycondensation process finally heat regarding the thing according to the material required [6]. The advancement of crystalline materials, for instance, nanoparticles or thin motion pictures and non-crystalline materials like stoneware, xerosol, airborne and glasses depends on the last warmth treatment steps [7]. This area gives the significant advances connected with sol-gel process, diverse controlling parameters, the size-and shape-controlled amalgamation of various metal oxides and usage of sol-gel organized metal oxide nanoparticles in various fields.

## 2. Materials and Method
### 2.1 Chemicals
All chemicals used in experiment were of analytical grade. The chemicals used in the synthesis were vanadium sulphate, $NH_4OH$ and thiourea. All the solutions were prepared in double distilled water.

### 2.2 Preparation of $VS_2$ nanoparticles
The exploratory set up is exceptionally basic. Sol is gotten by either hydrolysis or polymerization responses by including reasonable reagents in the antecedent arrangement.

The sol can be stored onto favored substrates as slight movies utilizing two methods, viz. (1) dip coating and (2) spin coating. The gelation procedure done through buildup of the sol or expansion of polymers changes over this sol to gel. This gel can be utilized to frame materials of various kinds, for example, nanoparticles, xerogel, glass or earthenware production relying on the further handling advances included. Nanoparticles and xerogels can be gotten by basic dissipation of dissolvable. The got xerogel can be framed as earthenware production by heat treatment and shiny nature can be actuated by liquefying procedures. In this way, sol-gel strategy can be utilized to get various types of materials, controlled stage and shape and size of the inferred materials [6].

1g of vanadium sulphate was dissolved in 25 ml of double distilled water. Then 9 ml of $NH_4OH$ was added. This mixture was stirred for 15 minutes at 80 °C. Thereafter 2g of thiourea was added and stirred for 15 minutes at 80 °C. Then it was filtered and washed several times with double distilled water. Then dried at 110-120 °C and calcined for 1 hour at 600 °C. Fig. 1 represents the preparation of vanadium disulfide nanoparticles.

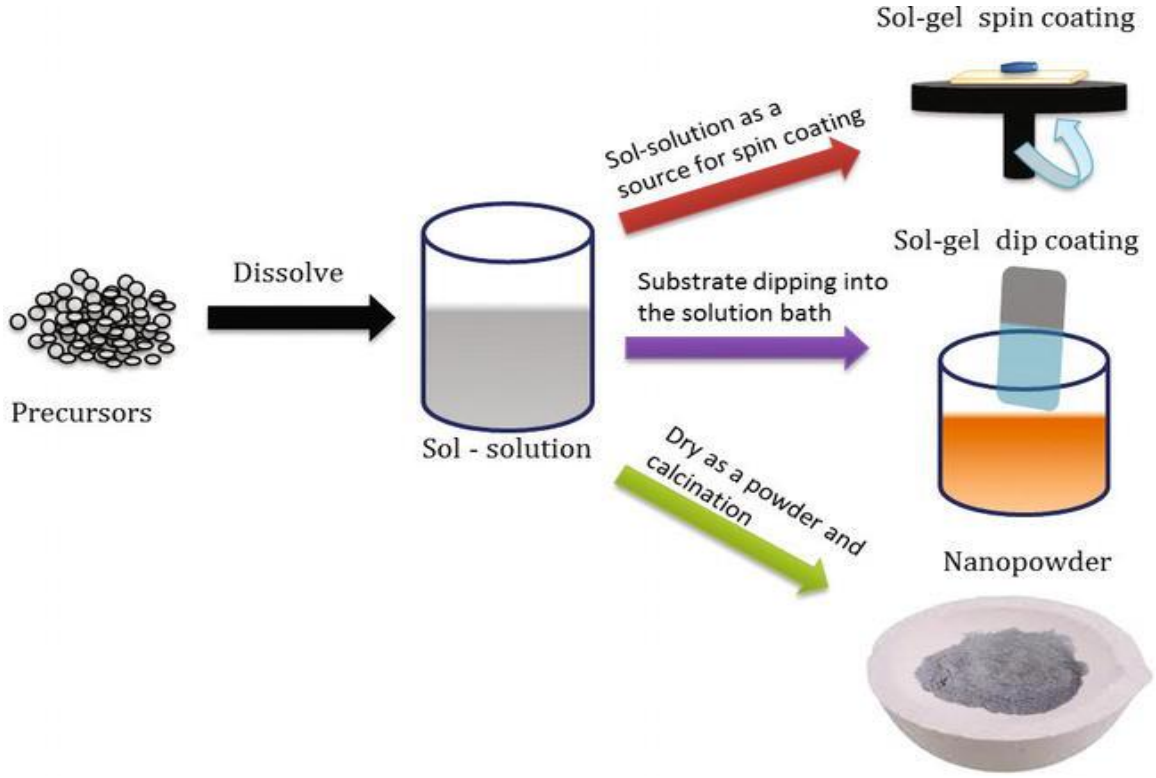
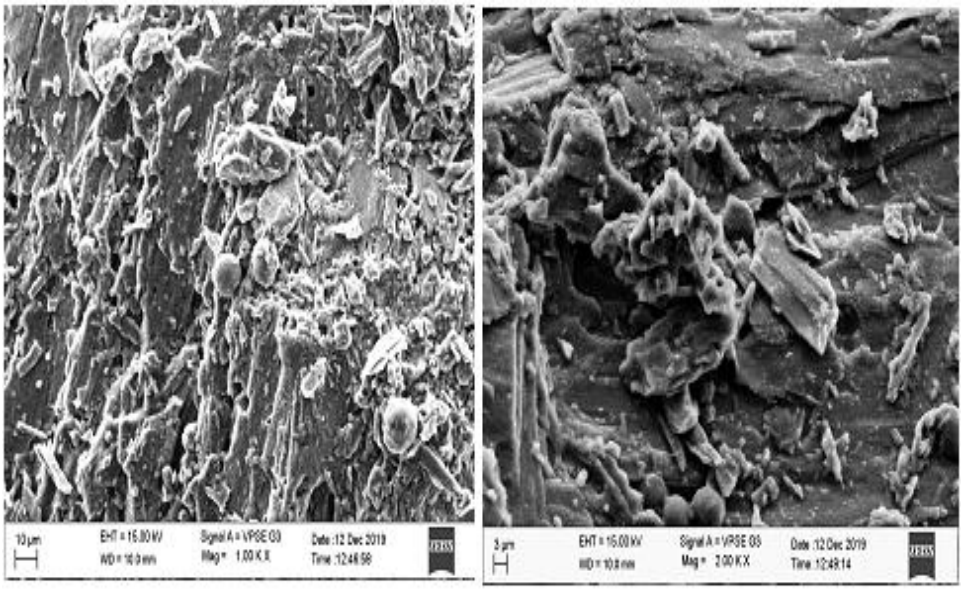



**Fig 1:** Preparation of $VS_2$ nanoparticles *(Source: https://www.intechopen.com/)*

## 3. Results and Discussion

### 3.1 SEM Analysis

The morphology of vanadium sulfide nanoparticles was carried out by scanning electron microscopy (SEM) measurement. Fig. 2 shows the SEM images of vanadium sulfide nanoparticles. This images shows that the formation of spherical and agglomerated nanoparticles with an average diameter of 158.5 nm.



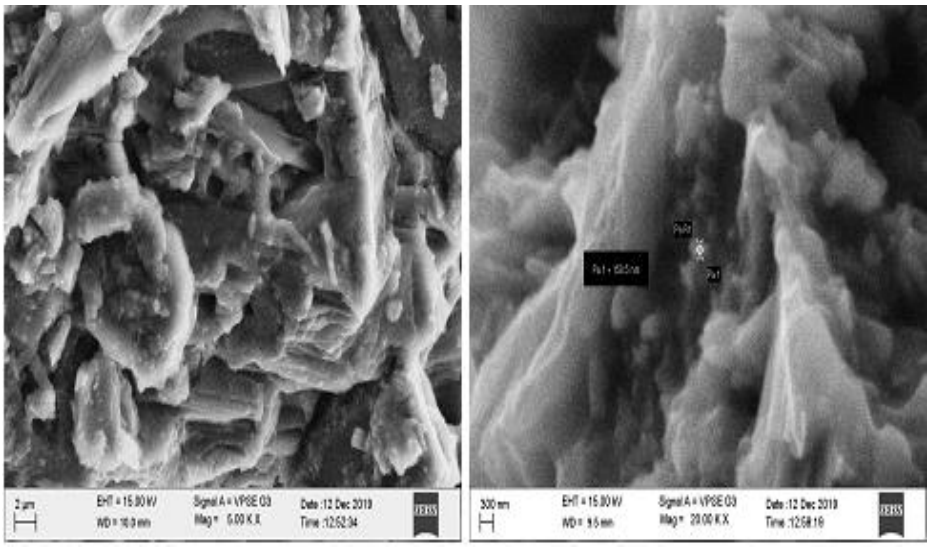


**Fig 2:** SEM images of $VS_2$nanopaticles

### 3.2 FT-IR Analysis

The formation of vanadium sulfide nanoparticles was also identified by FT-IR spectral studies. Fig. 3 shows the FT-IR spectra of $VS_2$ nanoparticles respectively.

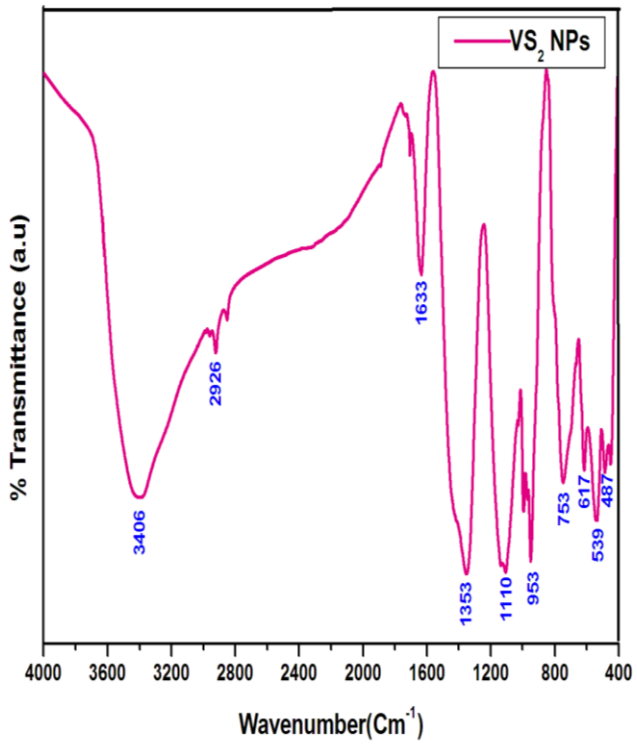



**Fig 3:** FTIR Spectra of $VS_2$ nanoparticles

The vibration band in 3406 $cm^{-1}$ is generally doled out to O-H extending vibration. The band saw at 2926 $cm^{-1}$ is relegated to the extending vibration of C-H group [8]. The feeble band at 1633 $cm^{-1}$ is credited to H-O-H bending vibration on account of ingestion of water atoms from air as the example is integrated in air [9]. The retention top at 1353 $cm^{-1}$ may be because of C-H plane bending vibrations. The top at 1110 $cm^{-1}$ speaks to the extending vibration of fragrant C-C bond. The top at 953 $cm^{-1}$ and 753 $cm^{-1}$ credited to C-H twisting vibration [10]. The top saw at 487 $cm^{-1}$ speaks to the arrangement of $VS_2$ nanoparticles

### 3.3 Energy Dispersive X-ray Analysis (EDX)

Substance structure investigation of all examples was finished by EDAX procedure. The Energy Dispersive X-ray (EDAX) examination was utilized to decide the level of vanadium and sulfur present in the $VS_2$ test. Vitality dispersive X- ray examination gives both subjective and quantitative data about the basic synthesis of the materials. Fig.4 shows EDAX spectra of Pure $VS_2$. From the EDAX spectra of the examples it is affirmed that the measure of V, S were near the target values and it is mediated that the as readied $VS_2$ nanoparticles are profoundly unadulterated

**Table 1:** Percentage of atomic and weight ratio of $VS_2$ Nanoparticles

| Element | Weight% | Atomic% |
|---|---|---|
| V K | 86.79 | 55.04 |
| S K | 13.21 | 55.96 |
| Totals | 100.00 | 100.00 |

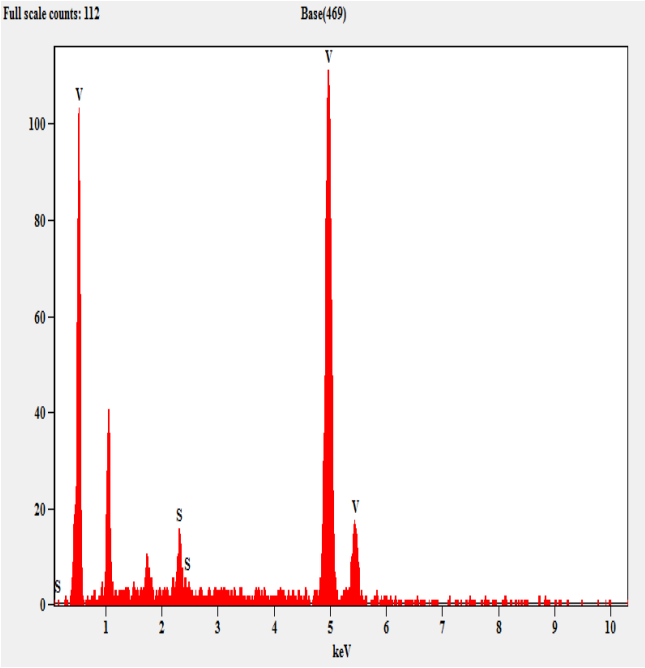



**Fig 4:** EDX spectrum of $VS_2$ nanoparticles

### 3.4 UV – Visible Spectroscopy Analysis

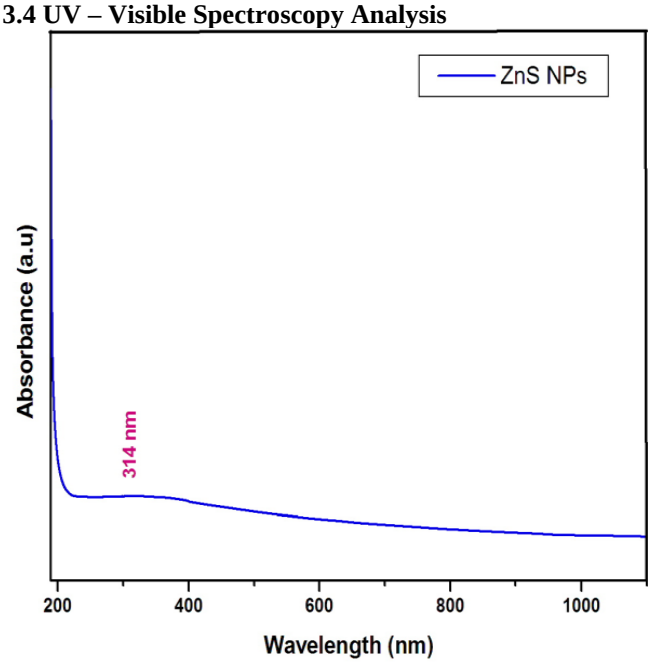



**Fig 5:** absorbance spectra of $VS_2$

Fig. 5 represents the absorbance spectra of the vanadium sulphide nanoparticles. The UV absorption spectra of $VS_2$ nanoparticles show a characteristics peak at a wavelength of 314 nm [11]. The peak corresponds to the formation of vanadium sulphide nanoparticles.

### 4. Conclusions

$VS_2$ nanoparticles were effectively combined by means of the concoction sol-gel technique utilizing vanadylsulphate. The SEM picture reveals that the $VS_2$ nanoparticles have spherical agglomerated nanoparticles. FTIR spectra show the possible stretching and bending modes of the $VS_2$ nanoparticles. EDAX examination affirms the nearness of vanadium and sulfur. From the UV–Visible absorbance range of unadulterated $VS_2$ nanoparticles is seen as 314 nm. In any case, to accomplish propelled applications, future examinations are as yet required in advancing the concoction steadiness and biocompatibility of $VS_2$.

### References

1. Pierre AC. Introduction to Sol-Gel Processing. New York: Springer, 2002.
2. Klein LC. Sol-Gel Technology for Thin Films, Fibers, Preforms, Electronics and Specialty Shapes. New Jersey: Noyes Publications, 1989
3. Klein LC. Sol-Gel Optics Processing and Applications. New York: Springer, 1994.
4. Attia Y. Sol-Gel Processing and Applications. New York: Springer US, 1994.
5. Reisfeld R, Jorgensen CK. Chemistry, Spectroscopy and Applications of Sol-Gel Glasses. Berlin: Springer-Verlag, 1992.
6. Levy D, Zayat M. The Sol-Gel Handbook: Synthesis, Characterization and Applications. Germany: Wiley-VCH Verlag GmbH & Co, 2015.
7. Lopez TM, Avnir D, Aegerter MA. Emerging Fields in Sol-Gel Science and Technology. New York: Springer US, 2003.
8. Chen F, Liu P, Zhao Q. Well-defined graphene/polyaniline flake composites for high performance supercapacitors, Electrochim. Acta. 2012; 76:62-68. doi:10.1016/j.electacta.2012.04.154. 49. Snook GA, Kao P, Best AS. Conducting-polymer-based supercapacitor devices and electrodes, J. Power Sources. 2010; 196:1-12. doi:10.1016/j.jpowsour.2010.06.084.
9. Bose S, Kuila T, Mishra AK, Rajasekar R, Kim NH, Lee JH. Carbon-based nanostructured materials and their composites as supercapacitor electrodes, J. Mater. Chem. Mater. Chem. 2012; 22:767-784. doi:10.1039/c1jm14468e.
10. Korzeniewski C, Conway BE. Proceedings of the Symposium on the Electrochemical Double Layer, The Electrochemical Society, Inc., New Jersey: USA, 1997.
11. Kumar H, Rani R, Salar RK. Synthesis of nickel hydroxide nanoparticles by reverse micelle method & its antimicrobial activity, Res. J. of Chem. Sci. 2011; 1(9):1-7