International Journal of Scientific Research & Engineering Trends
Volume 4, Issue 3, May-June-2018, ISSN (Online): 2395-566X

Chemical Reduction of Cu Nanoparticles on Tio_2" Project Report

Sathiyanarayanan.D
VIT Vellor,India
sathiyanarayanan140@gmail.com

***Abstract*- The experiment focuses on the chemical reduction of Cu nanoparticles on TiO2 by using NaBH4 as a reducing agent. The experiment includes observation of the coat formed under the influence of various concentrations of CuSO4 on the same amount of TiO_2. In this experiment, TiO_2 is of known quantity (300mg) is added to 100ml of water and stirred. This is then followed by the addition of $CuSO_4$. The solution of TiO_2 and $CuSO_4$ is then kept is ice bath and titrated against freshly prepared $NaBH_4$ solution of known quantity, drop by drop while continuous stirring using a magnetic stirrer. Once the titration is complete, the solution is stirred with a magnetic stirrer for about 3 hours. The experiment is carried out for varying quantities of $CuSO_4$. The final Cu coated TiO2 nanoparticles were subjected to XRD and the intensity with respect to the 2 theta and the absorbance with respect to wavelength was recorded. The alternative method to the reduction technique is the photo reduction which can be used to achieve similar coating. These coated nanoparticles can be further used in the procedure of separation of hydrogen from water.**

***Keywords*- POR, activation time, wake-up time, sequencing.**

I. INTRODUCTION

Chemical reduction is the process which results in the reactants to gain electrons. There are many reactions which occur in our daily life like rusting of iron, fading of colour from the clothes, burning of combustible substances such as domestic use gas, wood, coal, etc. In this experiment, reduction of Cu takes place from $CuSO_4$ to Cu to form Cu nano particles and $NaBH_4$ is used as the reducing agent.

II. PREPARATION OF TIO_2 NANOPARTICLES

1. Aim

To prepare Cu nanoparticles and its deposition on TiO_2 nanoparticles to form a nanoparticle system.

2.Standardization of $CuSO_4$

For the preparation of Cu nanoparticles to be coated on TiO_2, standardization of $CuSO_4$ is to be done. The $CuSO_4.5H_2O$ solution of 100 mL should be prepared with a concentration of 0.1M. 2.9g of $CuSO_4.5H_2O$ is added to 100mL of double distilled water and the solution is prepared.

3.Standardization of $NaBH_4$

The reducing agent used is $NaBH_4$. In this experiment 0.5 M solution of freshly prepared $NaBH_4$ is to be used. The solution is prepared by adding 1.9g of $NaBH_4$ and made up to 100mL by adding double distilled water. Since the solution should be freshly prepared, the solution should be prepared once the TiO_2 and $CuSO_4.5H_2O$ solution once the stirring has been started.

III. BASIC PROCEDURE

- 300mg of TiO2 is measured and added to 100ml double distilled water in a 250ml beaker (in 4 different beakers).
- The solution is stirred for 15 minutes.
- Standardization of CuSO4 → 0.1M CuSO4 is prepared by adding 2.5g of CuSO4.5H2O and is made up to 100ml mark in a standard measuring flask.
- Varying quantities of CuSO4 (i.e. 0.5ml, 1ml, 1.5ml, 2ml) are added to the prepared TiO2.
- After addition of CuSO4, the solution is stirred for 10 minutes in an ice bath.
- Standardization of NaBH4 – 0.5M of NaBH4 solution is prepared by adding 1.9g of NaBH4 in 100ml of double distilled water.
- 30ml of the solution is added drop by drop to the already stirring solutions placed in an ice bath.
- Once the NaBH4 is added, the solution is stirred vigorously for 3 hours.
- After 3 hours, the solution is filtered and the precipitate is dried with the help of a hot air oven at 80°C overnight.
- After drying, the precipitate is scraped from the filter paper and stored in a vial.

IV.OBSERVATION

TiO2 which is white in colour when stirred in 100 mL of distilled water and with $CuSO_4$ and titrated againstNaBH4 the following changes are observed.

- The colour of the sample from being white when TiO2 is added and stirred changes to turquoise blue with the addition of $CuSO_4$ and changes colour to dark brown after the titration against NaBH4 and stirring of three hours.
- This indicates the formation of Cu nanoparticles and its deposition on TiO2.
- This solution after it is dried in a hot air oven overnight at a temperature of 80˚C is in a powder form and is blue in colour. The colour of the particles slightly differs with the amount of $CuSO_4$ added.
- The obtained precipitate is then sent for the X-ray diffraction(XRD) for further analysis.

V.RESULT

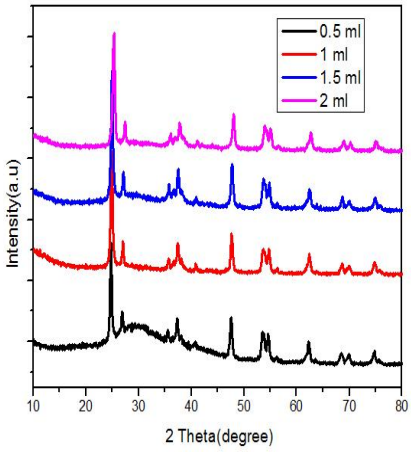

Fig.1 Intensity Vs 2 Theta Graph

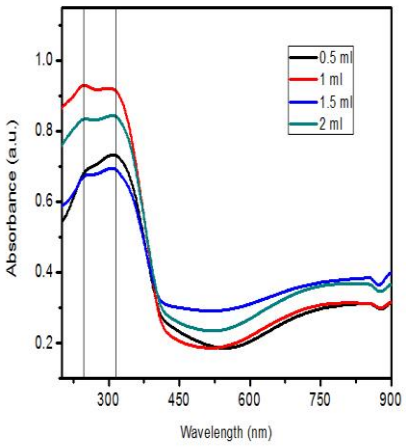

Fig.2 Absobrance Vs Wavelenght.

From the above result, we can clearly see there is a peak in the intensity vs 2 theta graph depicting the crystalline nature of the material and the formation of Cu nanoparticles and its deposition on TiO_2 and NPS

VI.INFERENCE

- The formation of Cu nanoparticles and its deposition on TiO_2 can also be done by photo reduction method using UV spectroscopy.
- The achieved nanoparticle system can be used in the production of hydrogen from water.

VII.CONCLUSION

In this experiment, we have successfully prepared a nanoparticle system of Cu and its deposition on TiO_2..

REFERENCES

[1]. https://www.sciencedirect.com/science/article/pii/S1003632610600477
[2]. https://pubs.acs.org/doi/full/10.1021/acs.chemrev.5b00482
[3]. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.653.7549&rep=rep1...%20
[4]. http://iaiest.com/dl/journals/7-%20IAJ%20of%20Science%20and%20Engineering/v3-i2-feb2016/paper1.pdf
[5]. https://www.ncbi.nlm.nih.gov/pubmed/25809844
[6]. https://scholar.google.co.in/scholar?q=chemical+reduction+of+cu+on+tio2&hl=en&as_sdt=0&as_vis=1&oi=scholart