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USE OF INTRA-VEIN SET AND SALINE BOTTLE AS A PRECIPITATE CONTROLLER IN MATERIAL SCIENCE RESEARCH

MULEY A.A.[1]*, PATIL R.R.[2] AND MOHARIL S.V.[3]

[1]Priyadarshani College of Engineering, Nagpur, MS, India.
[2]Institute of Science R.T.Road Civil Lines Nagpur, MS, India.
[3]Department of Physics R.T.M Nagpur University, Nagpur, MS, India.
*Corresponding Author: Email- aarti_muley@yahoo.com

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Abstract- In the nano material synthesis the commonly used method is the controlled co-precipitation. The controlled co-precipitation is done by several ways and several methods of controlling precipitation is found in literature. In this paper we describe the use of commonly available IV set and saline bottle as a precipitate controller. The results on the size of Na_2SO_4 synthesized using this assembly is also presented.
Keywords- Nano materials, Intra Vein Set, Synthesis Process

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Introduction

Tailoring material properties with the particle size is the hot topic in material science research. This has developed into a new field very well known as nano science and nano technology. Very useful properties have been found in several materials when synthesized in submicron to nanometer range.

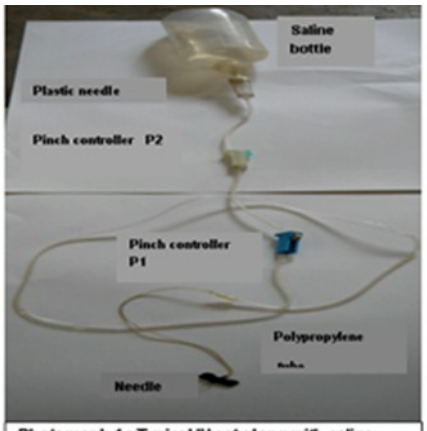
Modification of the material properties by synthesizing them as nano-particles is now well known. The nano metal particles show different properties than the corresponding bulk particles. Earlier the emphasis was on metals for their different behavior than the bulk but now the focus is shifted to optical magnetic as well as dielectric materials which find useful applications. Studies on metal nano particles have been extensively carried out from a wide variety of scientific and practical interest [1]. These nano particles consist of several tens or hundreds of metal atoms, mostly present on the surface of the particle. This introduces the quantum size effects or nanoscopic effects. The interest in nano luminescent materials was generated with the observation of increase in luminescence efficiency due to quantum confinement in ZnS;Mn [2]. A quantum leap in the number of publications on this topic can be noticed. Prior to these studies a decrease in luminescence efficiency with decreasing particle size (1-10 microns) was well known. This had been attributed to the manifestation of surface effects. In the nano range luminescence efficiency had been found to increase again. The increase is due to reduction in non radiative recombination due to quantum confinements. Apart from the efficiency, the other important luminescent properties like, emission and excitation spectra, life time
and decay characteristics, morphology of the phosphor etc are also altered when one moves from micro to nano regime. One hopes to find new luminescent materials useful in various applications by exploring the nanostructured luminescent materials.

Nano-Magnetic materials are another class of materials which is of much interest due to wide range of applications [3]. Due to particle size effects the intrinsic physical properties are observed to change compare to those the macroscopic counterparts[3]. This means that the intrinsic properties can be controlled and tailored with particle size. A particular material on a macroscopic scale has a limited number of physical parameters having certain values. However the same material shows additional phenomenon and most of these parameters can be adjusted by the size in nano scale allowing virtually continuous spectra for them. When particle size decreases below critical value, domain structure changes causing drastic modification in magnetic properties such as satu-

ration magnetization and anisotropy Curie /Neels temperature etc. Parameter like Curie or Neels temperature gets altered and one can vary the Curie/Neels temperature of the same material by controlling the particle size. This has got applications in cancer treatment. Nano magnetic thin films shows enhancement in magneto resistance several times than the bulk.

Zeolite is another class of materials which are studied in nanometer range. The size and morphology control of these materials has profound effect on its adsorbing properties [1].

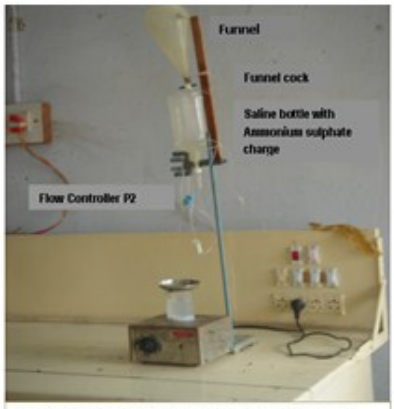
As discussed above the properties are sensitive to particle size hence synthesizing mono dispersed particles is important aspect in nano material research. Various techniques such as combustion synthesis, IGC, hydrous gel precipitation have been reported to prepare mono dispersed particles of these materials[4]. However the literature survey reveals that most commonly use method for the synthesis of these materials is the Controlled coprecipitaion method. In the method one reactant is added in controlled way to the other. The controlled reaction thus gives the particles in submicron to nano range. Mono dispersed particles are formed through the nucleation of the particle promptly in the initial stage of the reaction and particle growth only occurs after that. The mono dispersed particle can be obtain if somehow the nucleation stage and growth stage is separated [5]. One way of separating these stages is introducing one of the reactants in another reactant in controlled fashion and controlling the time interval between two consecutive reaction events. Here we describe the use of commonly available I-V set and saline bottle as a controlled precipitator to control the amount of reactant as well as time interval between two consecutive reaction events. This will help lot of material research people and students doing research in material science.



Photograph 1 : Typical IV set along with saline bottle

The commonly available IV set consists of Plastic needle, a 1.5m polypropylene tube of diameter 5mm (Photo 1). To one end another detachable tube along with the needle is attached. This needle of this detachable tube is the outlet of the liquid. This detachable tube can be changed when required. To the other end hard plastic needle is attached which is pierced in the saline bottle. A pinch cock or flow controller over the tube controls the liquid flow through the tube. The liquid flow through the IV set is controlled by setting the pinch cock as well as air opening in the saline bottle. In normal case a syringe needle of diameter 0.5mm is pierced to the saline bottle for air inlet and then the liquid flow is controlled by pinch cock. To use the saline bottle along with IV set as a controlled precipitator one has to modify this arrangement as one has to charge this bottle with the reactant solution. The modified arrangement is shown in Photo 2. A hole of diameter 7.5 mm is drilled at the base of bottle through which a cock with the funnel is glued with the silicone adhesive. This arrangement enables us to charge the saline bottle with different reactant solutions and thus can be reuse for several times. The cock can be opened and charge is added through funnel and then it is closed. The cock also works as a air opening to the bottle. By adjusting the cock position the air entering bottle is controlled and thus the liquid emanating from the IV set. This gives coarse arrangement to control liquid flow. The fine control over the liquid flow is obtained by pinch cock(Photo1:P2) over the tube. This gives good control over the rate of the flow of liquid from the tube. An additional pinch cock (Photo1:P1)is rolled over IV tube. This additional pinch cock is needed to function as a stop cock over the IV tube.

Experimental



Photograph 2: Complete set up for particles synthesis using IV- saline assembly

Photograph 2 also shows the typical arrangement for the synthesis of particles using modified IV set and saline bottle. Initially distilled water is charged pinch cock P1 is

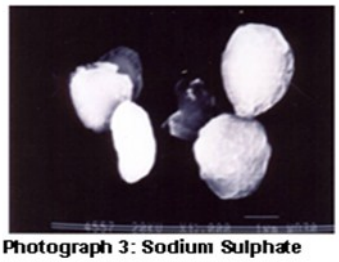
Open and the flow rate is adjusted by adjusting cock as well as and adjusting the flow controller (P2). The distilled water is then completely discharged from the saline bottle as well as from tube and pinch cock (P1)is then closed without disturbing the position of flow controller(P2). Now the saline bottle is charged with one of the reactants of desired normality. Second reactant of desired normality is placed in beaker placed on the magnetic stirrer. The magnetic stirrer is then started to stir the solution. When the stirrer achieves constant speed pinch cock (P1) is opened. The second reactant starts coming out of the needle orifice. As soon as it comes in contact with the reactant in beaker reaction takes place and particle is formed. This particle is then swept away towards the periphery of the beaker due to centrifugal force generated by the stirrer. Due to this second particle get separated from the first particle thereby preventing immediate agglomeration.

With this arrangement single drop is of 0.02ml size and the rate of the reactant flow through this arrangement can be adjusted from 10 drops per minute to 600 drops per minute. .Thus wide range of reaction rate is possible.

Synthesis of Na_2SO_4 particles

With above controlled precipitator we have synthesized Na_2SO_4

particles. 0.1 N Ammonium Sulphate alcoholic solution is charged in saline bottle. This solution was reacted with the constantly stirred 0.1 N alcoholic solution of Sodium acetate in beaker. A white precipitate is formed in beaker which is the decanted using centrifuge. The drop rate was kept at 20 drops per minute. Photograph 3 shows SEM image of the particles which shows more or less monodispersed particles of 1 μm size. The morphology is also uniform and is spherical morphology.



Photograph 3: Sodium Sulphate particles synthesized from IV

Conclusions

- A Saline bottle along with the IV set can be Use for carrying out controlled precipitation.
- Since the saline bottle and IV set is easily available everywhere, anybody even at remote places can use it.
- The arrangement is cost effective and whole assembly can be built around 100 Rs excluding the magnetic stirrer

References

[1] Waseda Y. Muramatsu (2003) Material Science.
[2] Bhargava R.N. and Gallagher D. (1994) *Phy. Rev. Lett*. 72(3), 416.
[3] Gupta T.K.S.P. and Verma S.S. (2003) *Nanotech* 3, 281.
[4] Halperin W.P. (1986) *Review of Modern Physics,* 58, 533.
[5] Ropp R.C (2003) *Solid State Chemistry' Elsevier Science*, 191.