

DAE Young Scientist Research Award Project

**Synthesis and Characterization of Binary Nanoparticles:
A Conjugate of Magnetic Nanoparticles and Semiconductor
Quantum Dots**

Sanction Order No. & Date:

2007/ 20/ 34/ 04/-BRNS/ 1865 Dated 21. 11. 2007

and

2007/ 20/ 34/ 04/ BRNS/ 517 Dated 19. 05. 2010

Progress Report

Principal Investigator: Dr. P. Deb
Associate Professor,
Department of Physics,
Tezpur University (Central University)

BOARD OF RESEARCH IN NUCLEAR SCIENCES (BRNS)

DEPARTMENT OF ATOMIC ENERGY

GOVERNMENT OF INDIA

Anushakti Bhavan, Chatrapathi Shivaji Maharaj Marg, Mumbai - 400 001

Scientific and Technical Progress Report (STPR)

(R & D Projects)

Section A: Project Details

A1. Project Title: Synthesis and Characterization of Binary Nanoparticles: A Conjugate

of Magnetic Nanoparticles and Semiconductor Quantum Dots

A2. DAE Sanction Order No. & Date: 2007/ 20/ 34/ 04/-BRNS/ 1865 Dated 21. 11. 2007

and

2007/ 20/ 34/ 04/ BRNS/ 517 Dated 19. 05. 2010

A3. Principal Investigator: Dr. P. Deb, Department of Physics, Tezpur University

A4. Institute: Tezpur University (Central University), Tezpur

A5. Address: Dr. P. Deb

**Principal Investigator
& Associate Professor,
Department of Physics,
Tezpur University (Central University)
Napaam, Tezpur-784028
Phone No.: +91 3712-267005, 267006
Email: pdeb@tezu.ernet.in**

A6. Total Cost: Rs. 17,07,500.00

DAE-BRNS has granted sanctions for the 'DAE YOUNG SCIENTIST RESEARCH AWARD' project proposal entitled "Synthesis and Characterization of Binary Nanoparticles: A Conjugate of Magnetic Nanoparticles and Semiconductor Quantum Dots" vide letter Nos. 2007/ 20/ 34/ 04/- BRNS/ 1865 dated 21. 11. 2007 and 2007/ 20/ 34/ 04- BRNS/ 3096 dated 04. 02. 2010 through the sanction Nos. 2007/ 20/ 34/ 04/-BRNS/ 1865 dated 21. 11. 2007 and 2007/ 20/ 34/ 04/ BRNS/ 517 dated 19. 05. 2010 for the implementation of the project.

Contents**Page No.**

1. Achieved objectives	1
2. Results and discussion	2
3. Summary and Conclusion	24
4. Details of new leads obtained	24
5. Consolidated expenditure statement	26
6. Instruments procured and installed	27

1. Achieved Objectives

Papers Published

1. *P. Deb, M. Gogoi, P.K. Karmakar* "Anomalous magneto-optic Faraday rotation behaviour due to resonant tunneling of magnetic moment" *J Opt* **41** (1), 2012, 41-47.
2. *D Roy, P Deb, A Basumallick, B Basu* "Studies on optical property of Fe₂O₃ nanoparticles synthesized by mechanical milling" *J Opt* **39** (2), 102-109.
3. *M. Gogoi, P. Deb* "Light scattering behavior of magnetic field induced directional self assembly of iron oxide nanoparticle suspension" *NANO* **7** (4), 2012, 1250027 (1-7).
4. *D. K. Bora, P. Deb* "Fatty Acid Binding Domain Mediated Conjugation of Ultrafine Magnetic Nanoparticles with Albumin Protein" *Nanoscale Res Lett* **4**, 2009, 138-143.
5. *P. Deb, K. Saikia* "Opportunities and Challenges in Nanoelectronics and Nanophotonics" in the *Physics behind electronics/ optoelectronics and their application* **1**, 2011, 70-75

Paper Communicated

1. "Magneto-fluorescent hybrid of dye and SPION with ordered and radially distributed porous structures" by M. Gogoi and P. Deb has been communicated (2013).

2. Results and Discussions

2.1 Anomalous magneto-optic Faraday rotation behaviour due to resonant tunneling of magnetic moment

Abstract

We demonstrate here the quantum mechanical behavior of non-linear Faraday rotation exhibiting steps with the support of experimental results. The step-like behavior, satisfying a well organized condition $1/\theta = (K\lambda n)/h$, is a consequence of resonant tunnelling of magnetic moment. The degeneracy of quantum states arising from the projection of magnetic moments of the smaller sized quantum particles in adopting a series of discrete values, leads to 'Quantized Faraday effect'. Taking it into consideration, the Faraday Effect is studied through a non-local approach. The magnetodynamical equation is developed in magnetic space and solved analytically as well as numerically. The analytically obtained non-linear behavior of Faraday rotation is found to be in good agreement with the non-linear fit of the experimental result. In this work, we have studied the Faraday rotation experiment carried out with ferrofluid sample of γ -Fe₂O₃ nanoparticles dispersed in non-magnetic polyvinyl alcohol (PVA) matrix. The results showed step-like behaviour of Faraday rotation angle with increase in applied magnetic field strength. This anomalous behaviour is the manifestation of resonant tunneling of magnetic moment in case of quantum confined magnetic nanoparticles. Moreover, the Faraday rotation experiment for a complete cycle of applied magnetic field on the same sample revealed 'magneto-optic hysteresis loop', ensuring it as a sensitive tool for measurement of magnetic properties of superparamagnetic particles

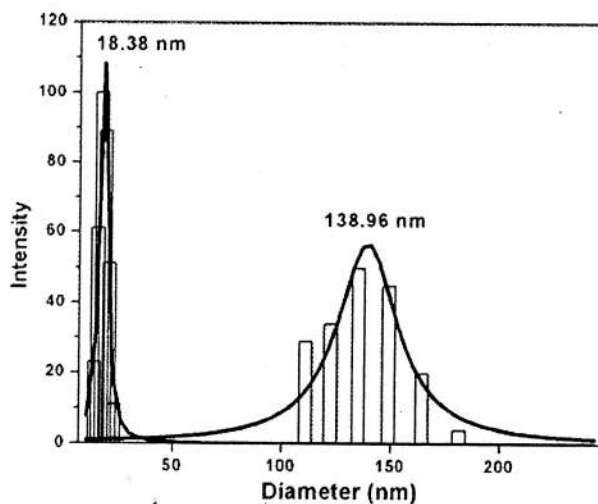


Fig. 1 Particle size distribution by $\gamma\text{-Fe}_2\text{O}_3$ nanoparticles in PVA matrix along with the fitted curves from DLS study. The results show the presence of two types of particles: quantum particles with average diameter of 18.38 nm and classical particles with average diameter of 138.76 nm

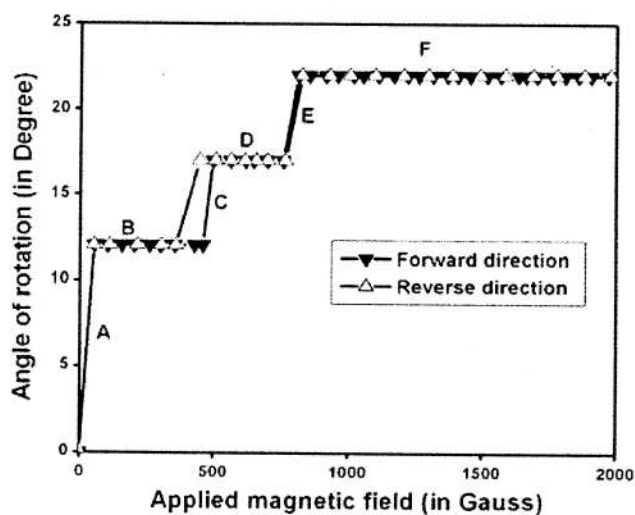


Fig. 2 Faraday rotation angle variation in low dimension system. The angle of rotation of plane of polarization of the light beam propagating through ferrofluid of single domain magnetic nanoparticles exhibit step-like behavior. A, C and E are the steep portion of the curve representing linear variation. B and D are plateaus due to resonant tunneling and F, saturation behavior

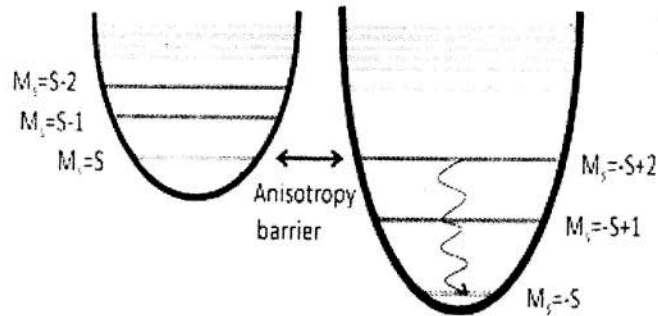


Fig. 3 Schematic representation of resonant tunneling. The tunneling from the metastable state $M_s = S$ to $M_s = -S+2$ is shown followed by decay to the ground state $M_s = -S$

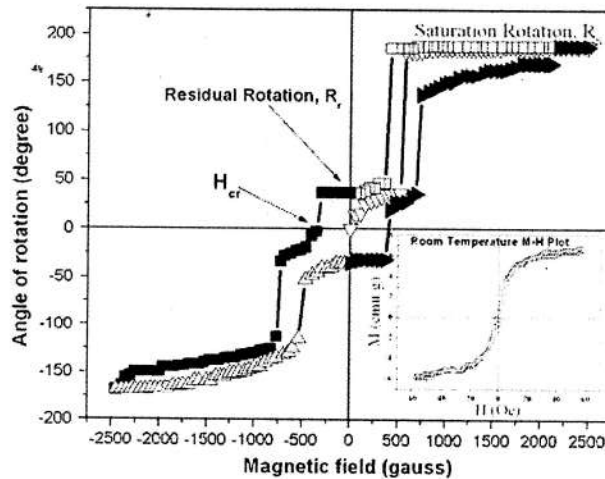


Fig. 4 Magneto-optic Hysteresis. Faraday rotation measurement for a complete cycle of applied magnetic field

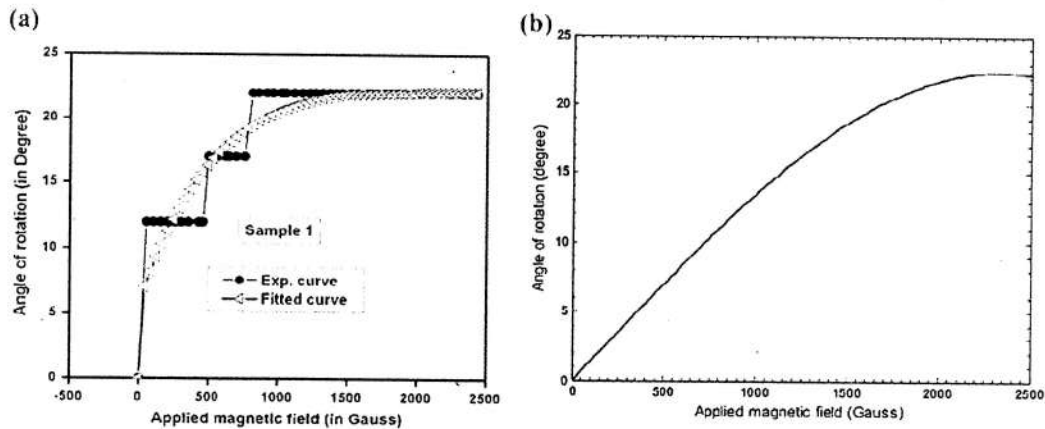


Fig. 5 a Experimental Faraday rotation curve along with the best fitted curve for sample S1 and **b** Numerically generated profile of angle (θ) of rotation with strength (H) of magnetic field with the initial values $\theta_i = 0.867 \times 10^{-13}$ and $(d\theta = dH)_i = 1.0 \times 10^{-11}$

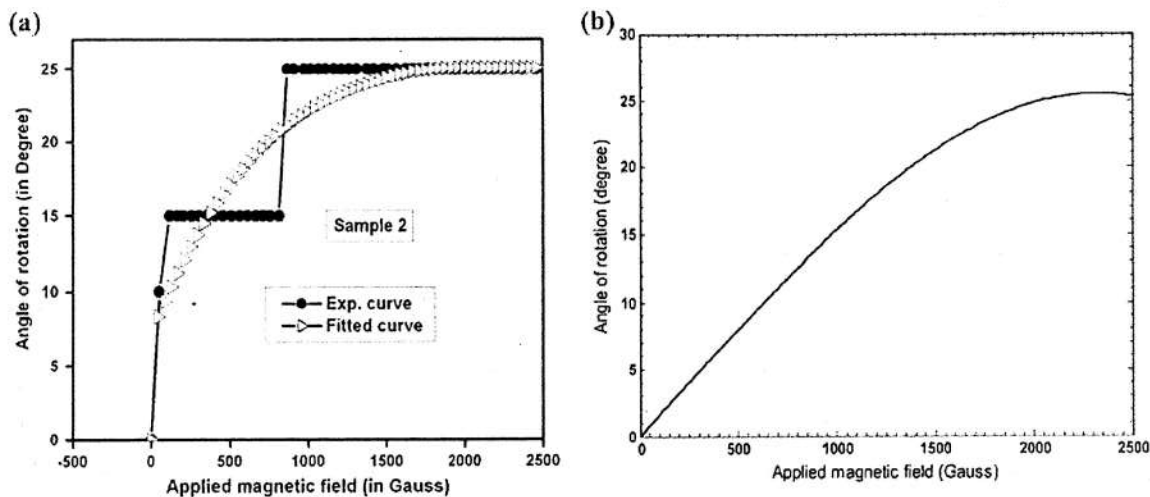


Fig. 6 a Experimental Faraday rotation curve along with the best fitted curve for sample S2 and b Numerically generated profile of angle (θ) of rotation with strength (H) of magnetic field with the initial values $\theta_i = 0.867 \times 10^{-13}$ and $(d\theta=dH)_i = 1.0 \times 10^{-11}$

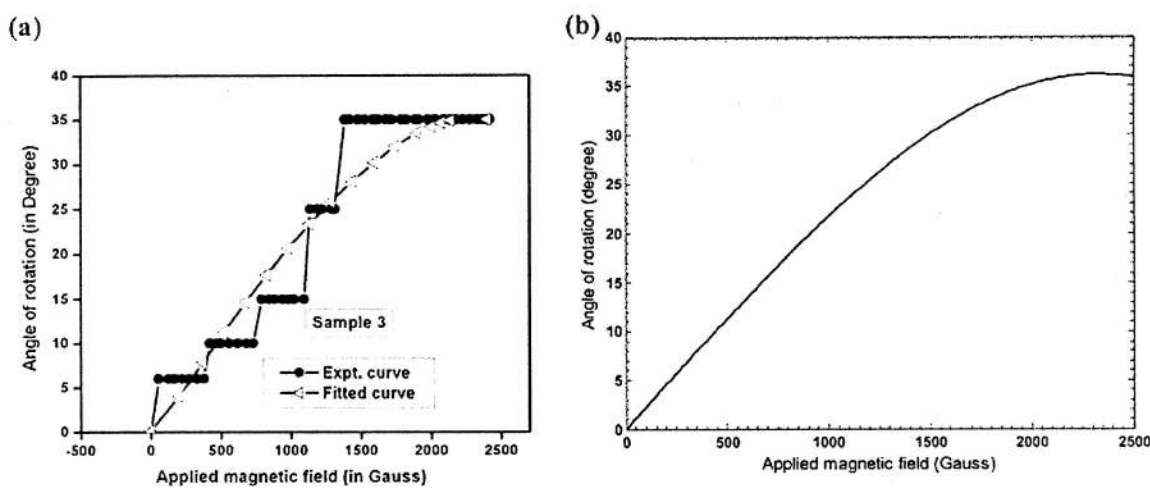


Fig. 7 a Experimental Faraday rotation curve along with the best fitted curve for sample S3 and b Numerically generated profile of angle (θ) of rotation with strength (H) of magnetic field with the initial values $\theta_i = 0$ and $(d\theta=dH)_i = 0.9 \times 10^{-11}$

Conclusion

We have presented a theoretical and experimental evidence of quantized Faraday Effect to explain the step-like behavior of the Faraday rotation angle. The manifestation of this effect to low-dimensional magnetic system was performed by the experiment on ferrofluid of ultrafine $\gamma\text{-Fe}_2\text{O}_3$ nanoparticles. We also established that this quantization is attributed to resonant tunneling of magnetic moment in case of smaller sized quantum particles. The resonant tunnelling phenomenon occurs at the applied magnetic field at which magnetic moment of quantum confined particles can support this through the potential anisotropy barrier. To give a quantified estimation to the non-linear Faraday rotation behavior we have given a non-local treatment to it by constructing a magneto-dynamical equation and then solving it both analytically as well as numerically. We find good agreement between the best fitted curves of the experimental profiles and the numerically generated curves.

2.2 Studies on optical property of Fe_2O_3 nano-particles synthesized by mechanical milling

Abstract

Fe_2O_3 nano-particles are synthesized by mechanical milling at room temperature. Dry milling technique has been found to be effective method of particle size reduction of Fe_2O_3 . The particle size and lattice strains have been determined by x-ray diffraction (XRD) and high resolution transmission electron microscopy (HRTEM). For studying optical properties, UV-Visible and photoluminescence (PL) spectroscopy have been done. The results reveal that different milling conditions influence the optical properties. This study also reveals that not only the surface layer but the interfacial region between the α and γ phases also plays an important role for photoluminescence emission of ultra fine nanoparticles in visible light region.

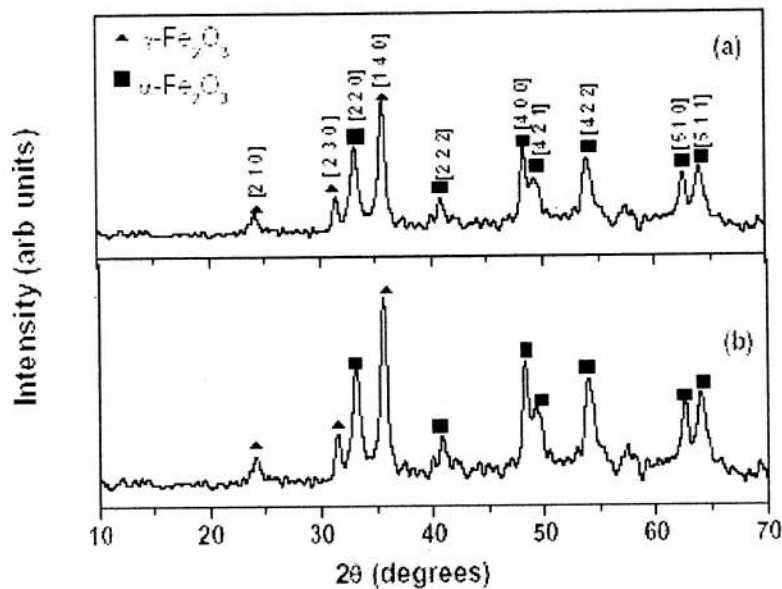


Fig1 The XRD patterns of (a) 30 hours and (b) 40 hours dry-milled nano Fe_2O_3

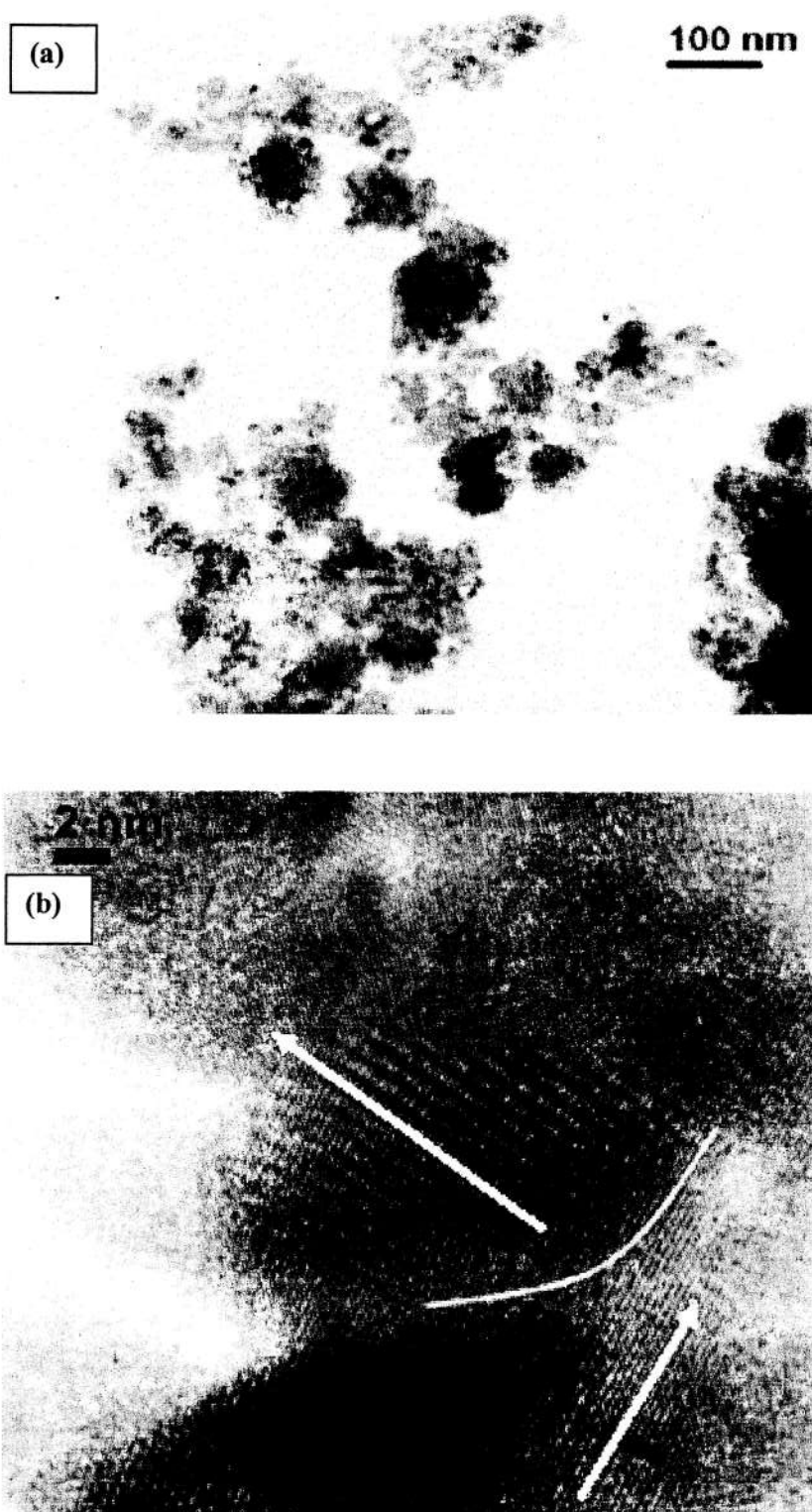


Fig.2 (a) Transmission electron micrograph for 30 hour dry milled nano Fe_2O_3
(b) high resolution TEM image for 40 hour dry milled nano Fe_2O_3

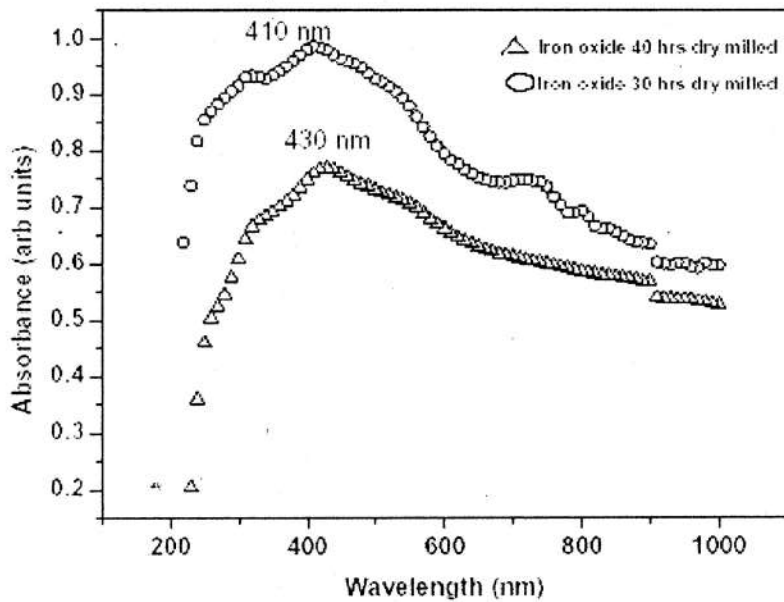


Fig.3 UV-Visible absorbance spectra of 30 hours and 40 hours dry milled nano Fe_2O_3

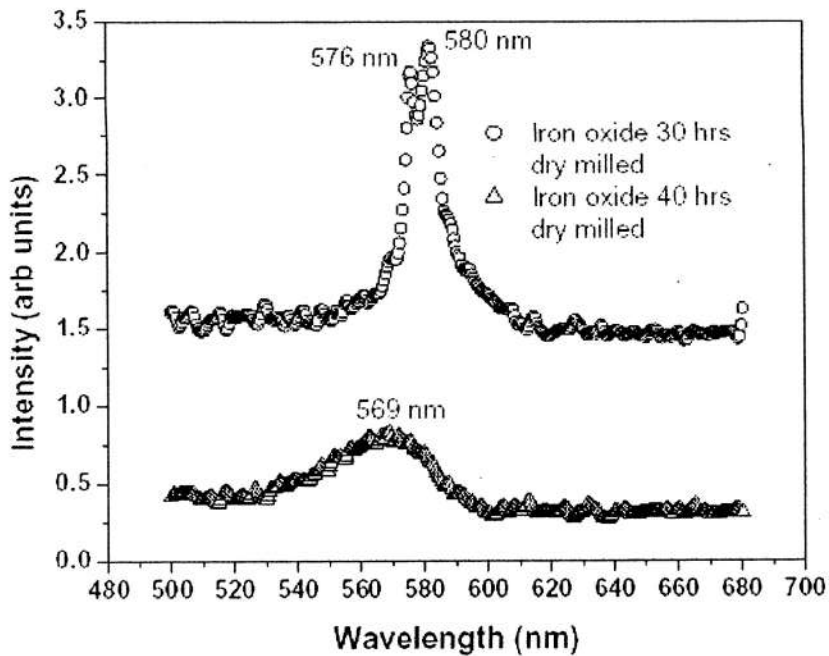


Fig.4 PL emission spectra of 30 hours and 40 hours dry milled nano Fe_2O_3

Conclusion

It was concluded that the particle size can be effectively reduced by high energy mechanical milling. The XRD pattern reveals that there is a mixture of two phases α and γ - Fe_2O_3 , which is corroborated by the HRTEM images. From the optical properties study with the aid of PL

and UV-Visible spectroscopy, a blue shift has been observed for 40 hours dry milled nano Fe_2O_3 , which refers that there is decrease in particle size. The interfacial region between the α and γ phases plays a vital role in PL, since the PL peak intensity is higher than absorption peak. Preliminary results suggest that high-energy mechanical milling may modify the particle size, resulting in states located in an interfacial region between the α and γ phase. In case of high energy milling, the crystallinity decreases and hence a broadening in the PL peak in case of 40 hours dry milled nano Fe_2O_3 is observed. The optical properties revealed that the emission peaks are at visible light region, which suggest that these nanoparticles can be used for various opto-electronic devices.

2.3 Light scattering behavior of magnetic field induced directional self assembly of iron oxide nanoparticle suspension

Abstract

The magnetic control on scattering of light by ultrafine iron oxide ($\gamma\text{-Fe}_2\text{O}_3$) nanoparticles suspended in a carrier liquid was investigated. The light scattering behaviour was studied using laser light under the influence of a permanent magnet over a rotating frame of reference. When the magnet is rotated continuously from 0° to 360° with respect to the direction of the incident laser beam, the scattered light pattern from the sample has the same angular displacement but in counter direction to the magnetic field rotation. When external field is not applied to the ferrofluid, no other preferred directional scattering of light is observed. The applied magnetic field induces directional self assembly of magnetic nanoparticles through dipole dipole interactions. This finally leads to the formation of "nanoparticle grating" and the optical geometry of diffraction grating clearly describes the anomalous scattering behavior of the ferrofluid. Most interestingly, for each complete orientation of the field from 0° to 360° , the transmitted light intensity switches between maxima and minima for longitudinal and transverse applied magnetic fields.

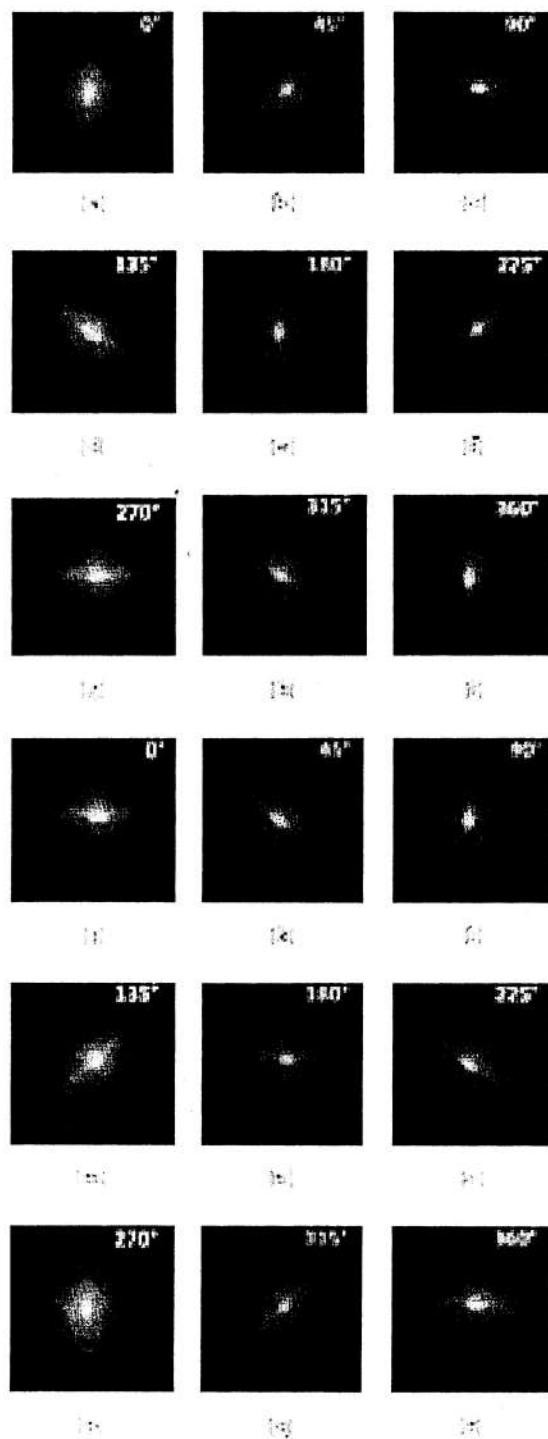


Fig. 1. (a-i) Scattered light pattern when bar magnet is rotated anticlockwise (a) 0° , (b) 45° , (c) 90° , (d) 135° , (e) 180° , (f) 225° , (g) 270° , (h) 315° and (i) 360° from its initial longitudinal position to the incident beam direction and (j-r) scattered light pattern at the same rotation angles of the applied magnetic field in anticlockwise direction from its initial transverse position to the incident beam direction.

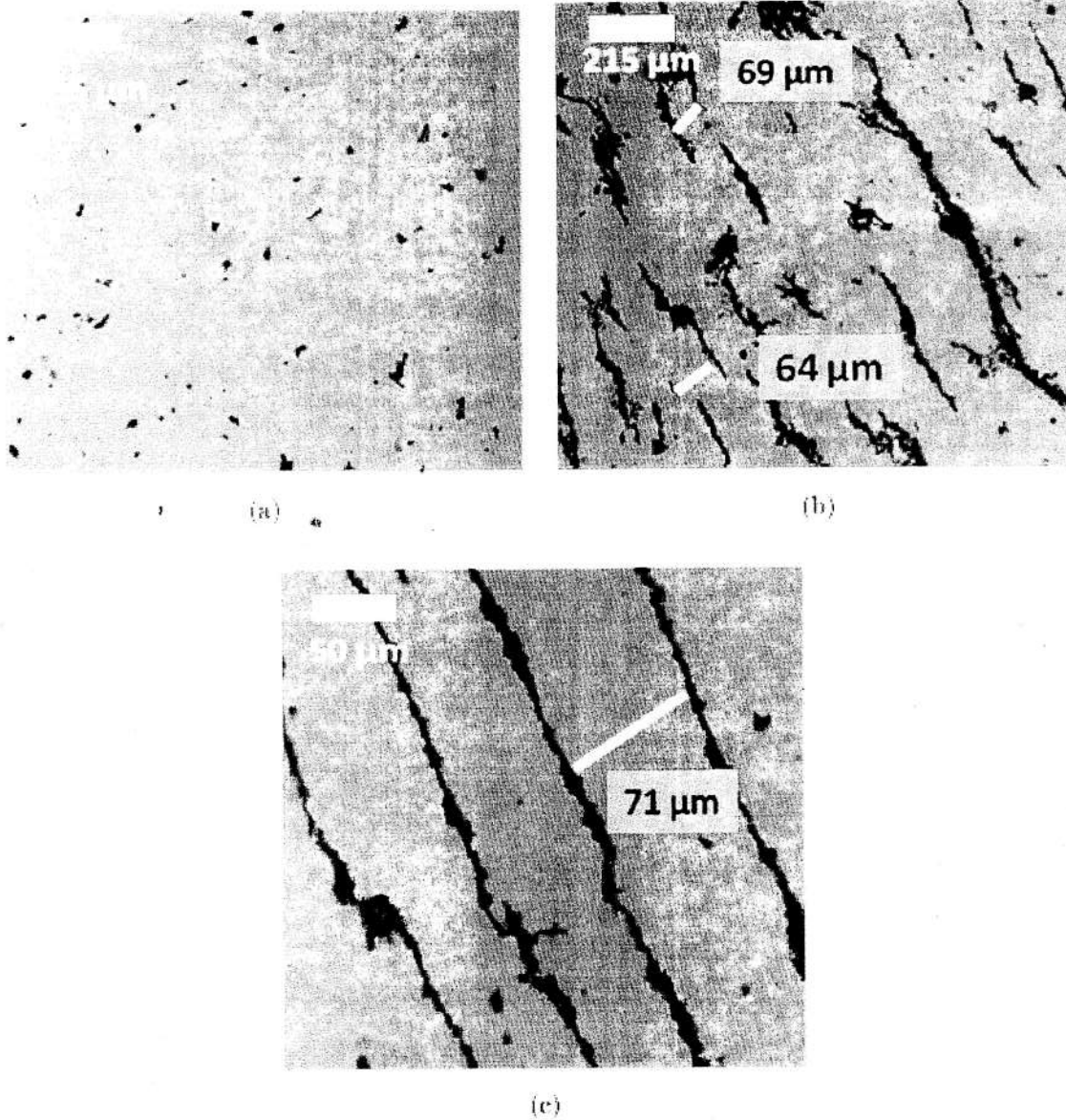


Fig. 2. Optical micrographs of the sample under no field (a) shorter, (b) at 10× mag. and longer time (15 min) and (c) exposure under the field at 40× mag.

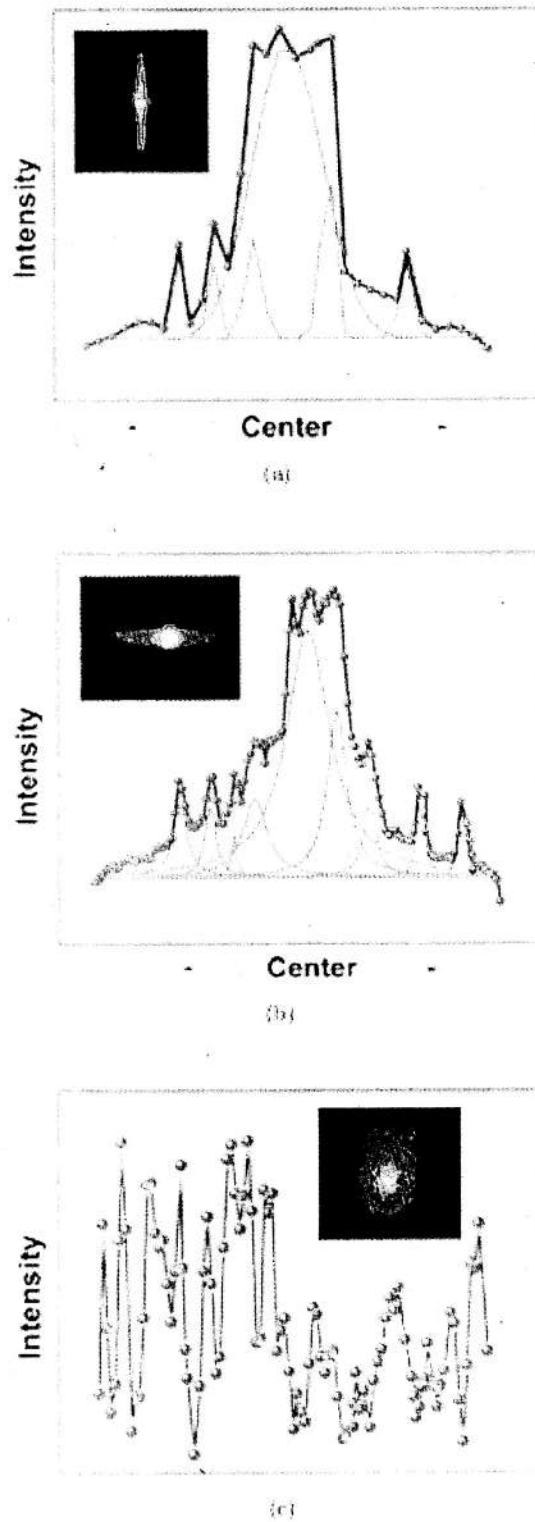
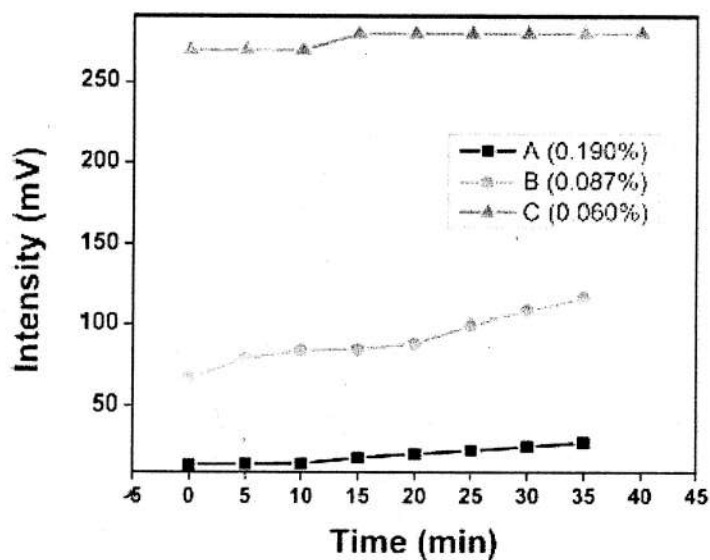
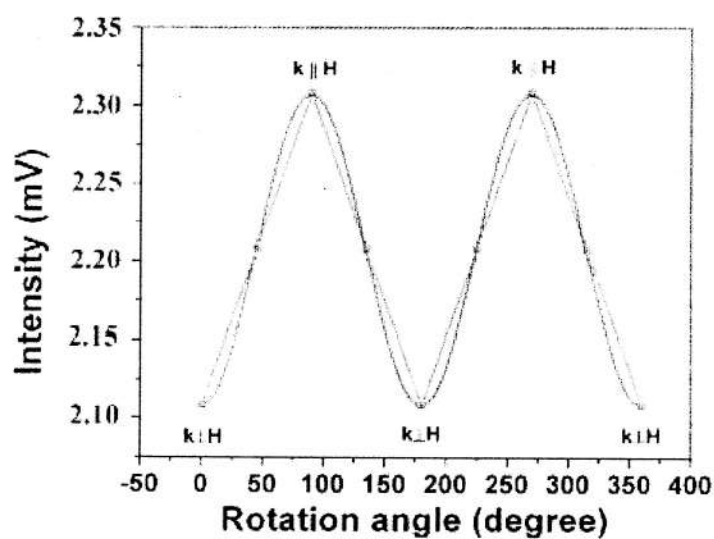


Fig. 3. K plot profile of the scattered light patterns (a) in presence of longitudinal field, (b) in presence of transverse field and (c) absence of field. The inset shows the patterns.



(a)



(b)

Fig. 4 (a) Time evolution plot of transmitted intensity of laser light from three samples with concentrations $A=0.19\%$, $B=0.087\%$ and $C=0.06\%$ by weight and **(b)** variation of intensity of transmitted light with respect to different angle of rotation of the magnetic field. The field was applied initially in a transverse position with respect to the incident beam direction. The red line shows the fitted curve by sinusoidal wavefunction fitting (color online).

Conclusion

We studied the effect of magnetic field on transmitted light intensity and the scattering of light from ferro- fluid of γ -Fe₂O₃ nanoparticles. It has been found that the scattered light diffraction pattern can be tuned by orienting the direction of the applied magnetic field in different angles ranging from 0° to 360°. The tunability effect has been realized by the nanoparticle grating formation in the ferrofluid sample in presence of applied magnetic field. We observed that the transmitted light intensity switches between maximum and minimum for longitudinal and transverse applied magnetic fields. This is due to the different arrangements of the nanoparticle grating in accordance with the direction of applied magnetic fields.

2.4 Fatty acid binding domain mediated conjugation of ultrafine magnetic nanoparticles with albumin protein

Abstract

A novel bioconjugate of stearic acid capped maghemite nanoparticle (γ -Fe₂O₃) with bovine serum albumin (BSA) was developed by taking recourse to the fatty acid binding property of the protein. From FT-IR study, it was found that conjugation took place covalently between the amine group of protein molecule and carboxyl group of stearic acid capped maghemite nanoparticle. TEM study further signified the morphology of the proposed nanobioconjugate. The binding constant of nanoparticle with protein molecule was evaluated from the optical property studies. Also, magnetic measurement (M-H) showed retaining of magnetic property by significant values of saturation magnetization and other hysteretic parameters.

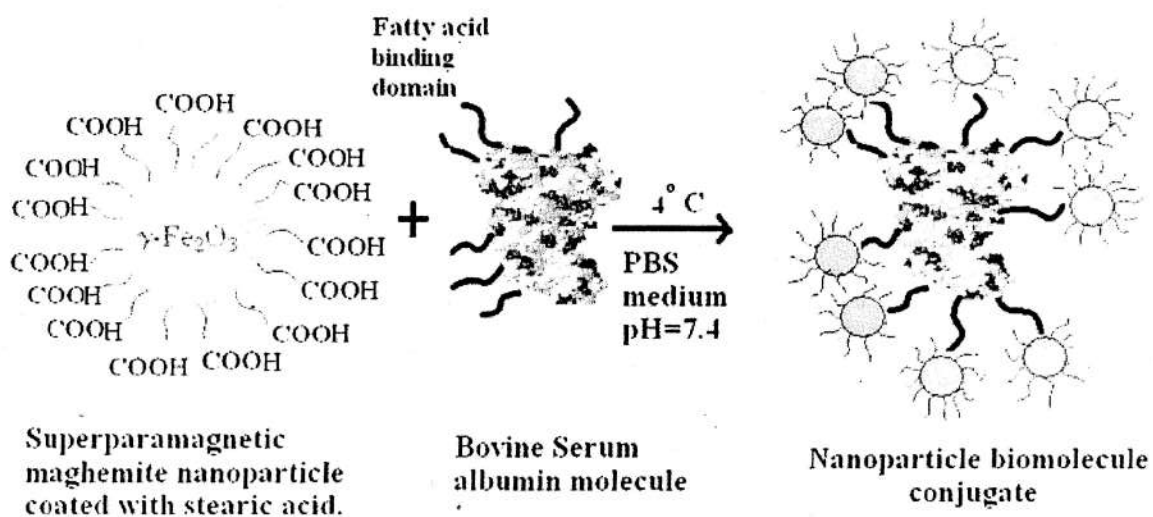


Fig. 1 The conjugation scheme of maghemite nanoparticle with bovine serum albumin

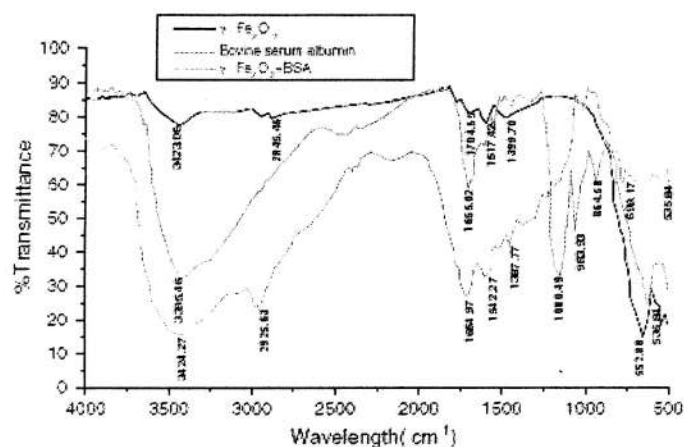


Fig. 2 FT-IR spectra of maghemite nanoparticle before and after the conjugation with BSA

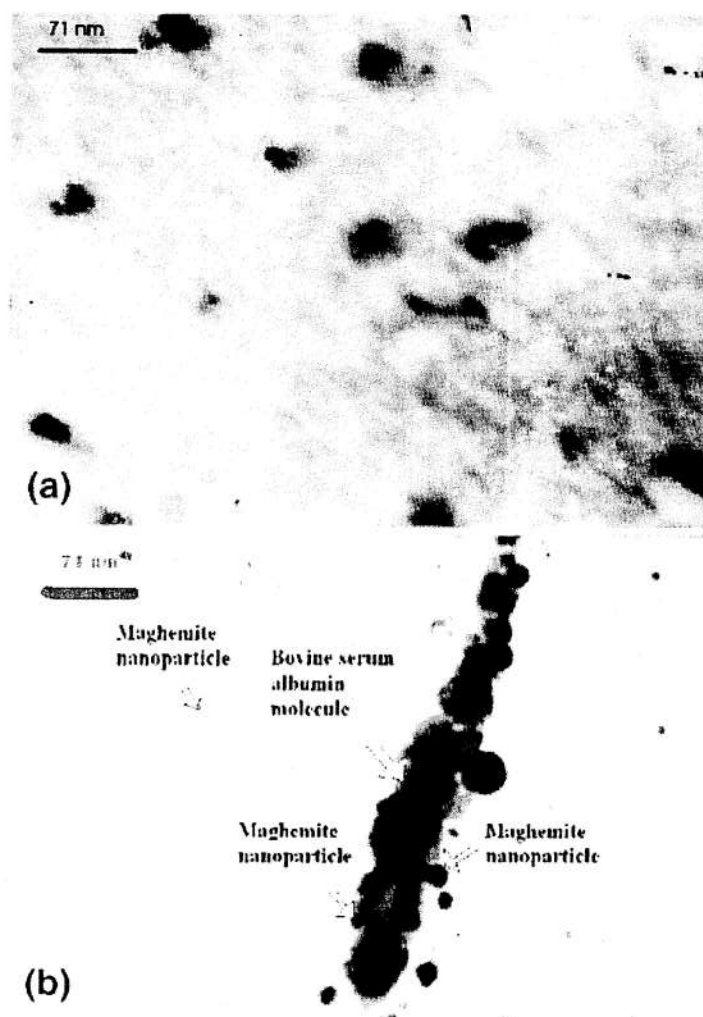


Fig. 3 TEM micrograph of the conjugate of maghemite nanoparticle with elongated bovine serum albumin molecule

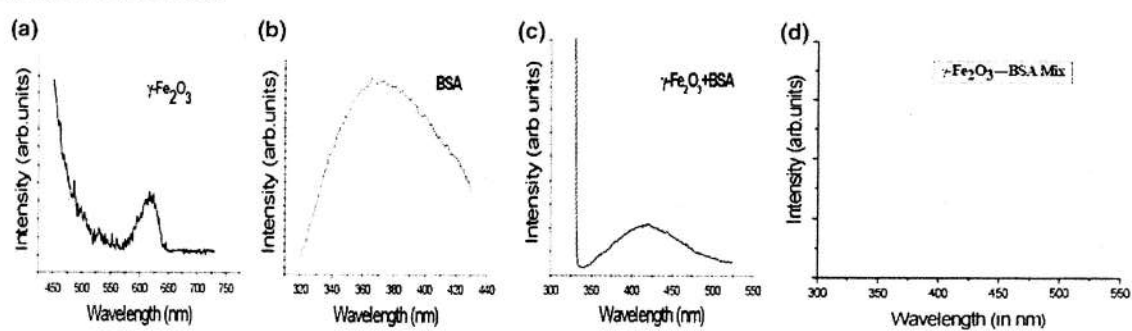


Fig. 4 The photoluminescence spectra of a maghemite nanoparticle b BSA c maghemite/BSA nanobioconjugate d Maghemite/BSA mixture

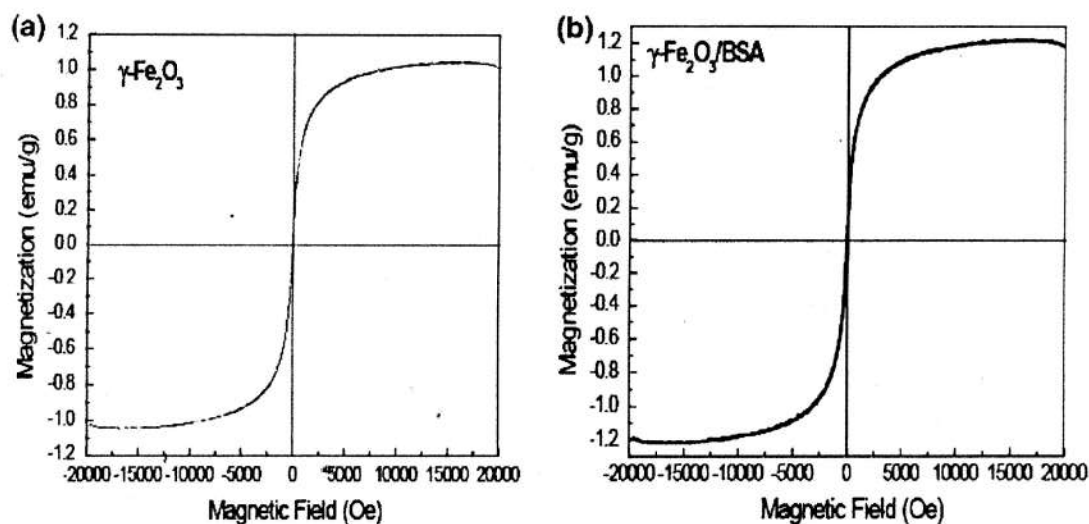


Fig. 5 Room temperature (300 K) M–H data of **a** Maghemite and **b** Maghemite/ BSA nanobiconjugate

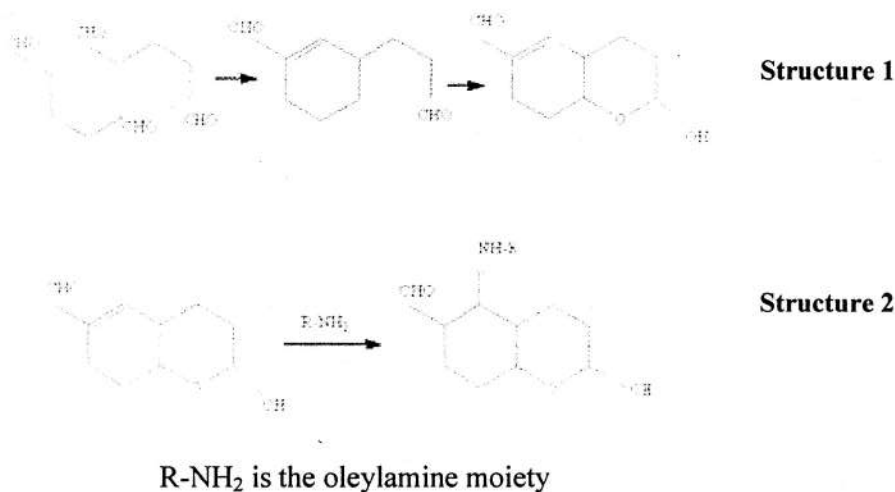
Conclusion

In summary, we developed a simple technique for the synthesis of bioconjugate of maghemite nanoparticles with BSA molecule by using the covalent interaction between the fatty acid binding domains of BSA molecule with stearic acid capped nanoparticles. This will lead to the development of non-toxic iron oxide nanoparticles using BSA as a biocompatible passivating agent. We confirmed the formation of the same from the FT-IR spectra as well as TEM micrograph. We also established the well retaining of magnetic property of nanoparticles after the formation of bioconjugate from M–H study. It is worth mentioning here that this is the first report on conjugation of nanoparticles with biomolecules by utilizing biologically evolved linker moiety in covalent fashion. The designed magnetic bioconjugate seems to be applicable for targeted delivery purpose to a neoplastic cell due to the receptor action of the BSA molecule by binding to a wide variety of lipophilic compounds such as steroid present over cancer cell.

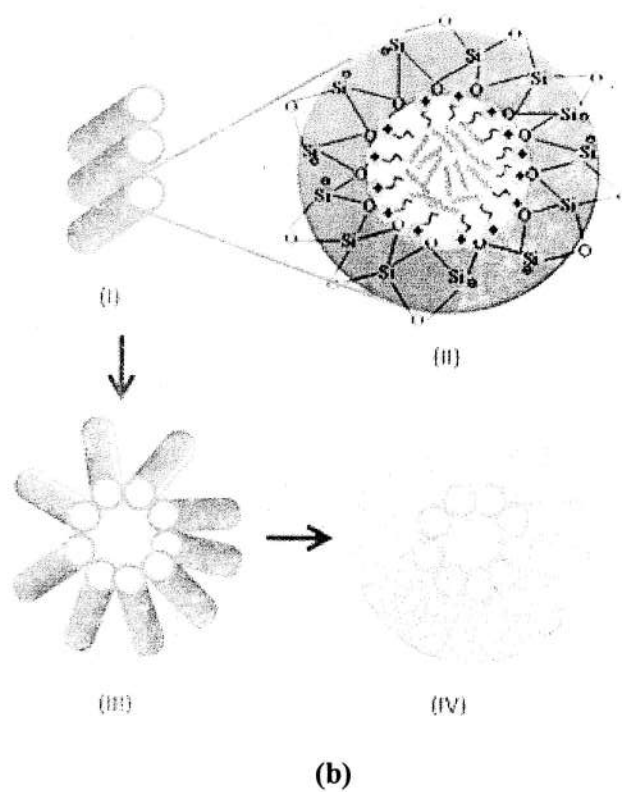
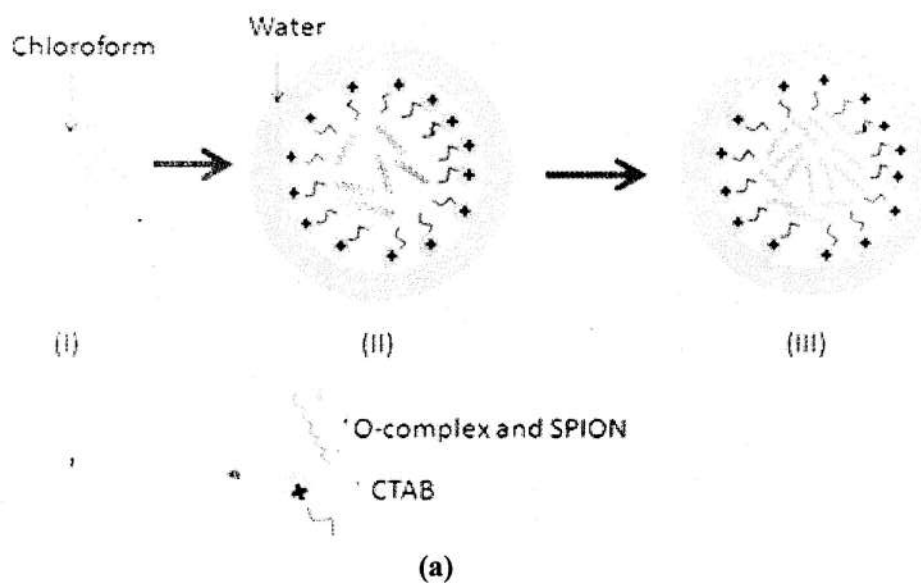
2.5 Magneto-fluorescent hybrid of dye and SPION with ordered and radially distributed porous structures

Abstract

We have reported the development of a silica based magneto-fluorescent hybrid of a newly synthesized dye and superparamagnetic iron oxide nanoparticles with ordered and radially distributed porous structure. The dye is synthesized by a novel yet simple synthetic approach based on Michael addition between dimer of glutaraldehyde and oleylamine molecule. The surfactant used for phase transformation of the dye from organic to aqueous phase, also acts as a structure directing agent for the porous structure evolution of the hybrid with radial distribution. The evolution of the radially distributed pores in the hybrids can be attributed to the formation of rod-like micelles containing nanoparticles, for concentration of micelles greater than critical micelle concentration. Removal of the surfactants by a novel water extraction method ultimately yields the uncommon/ particular porous structure of the hybrid. Adsorption isotherm analysis confirms the porous nature of the hybrids with pore diameter around 2.4 nm. A distinct modification in optical and magnetic property is observed due to interaction of the dye and SPION within the silica matrix. The integration of multiple structural components in the so developed hybrid nanosystem results into a potential agent for multifunctional biomedical application.



Scheme 1. Glutaraldehyde dimer (structure I) formation at basic pH and its Michael addition with oleylamine to yield O-complex (structure II)



Scheme 2. Schematic representation of (a) the phase transformation of the O-complex and SPIONs from oil to water phase and (b) the hybrid formation with radial distribution of porous structure

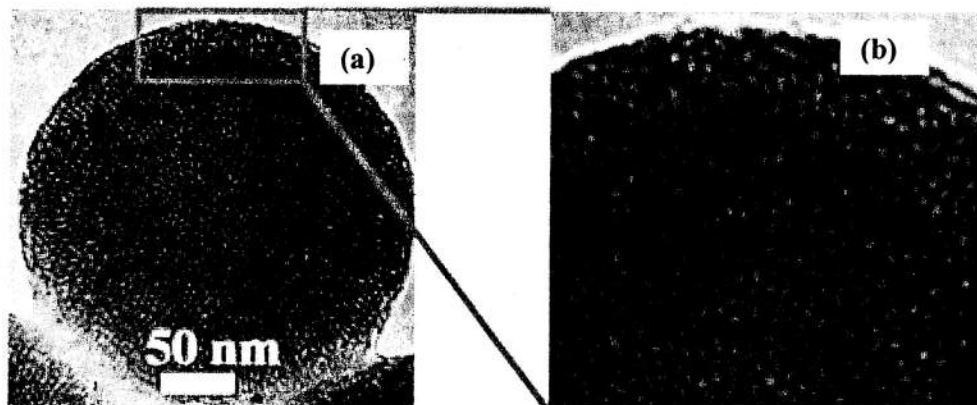


Fig. 1. (a) HR-TEM image of single hybrid particle with radial distribution of pore channels and (b) the enlarged image of the small portion of (a)

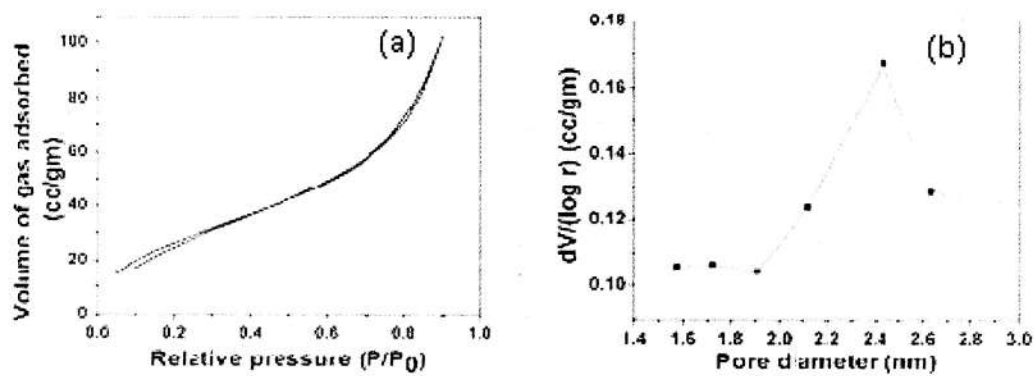


Fig. 2. (a) N₂-sorption isotherm and (b) Pore size distribution plot of the hybrid

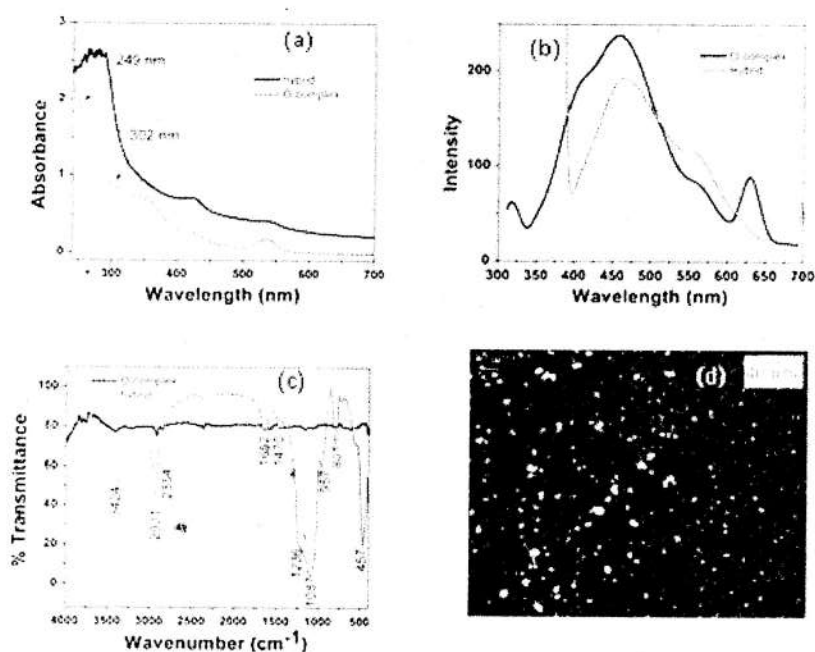


Fig. 3 (a) UV-Visible absorption spectra, (b) Photoluminescence spectra, (c) FTIR spectra of O-complex and hybrid and (d) Fluorescence micrograph of hybrid excited with UV-light (Filter A)

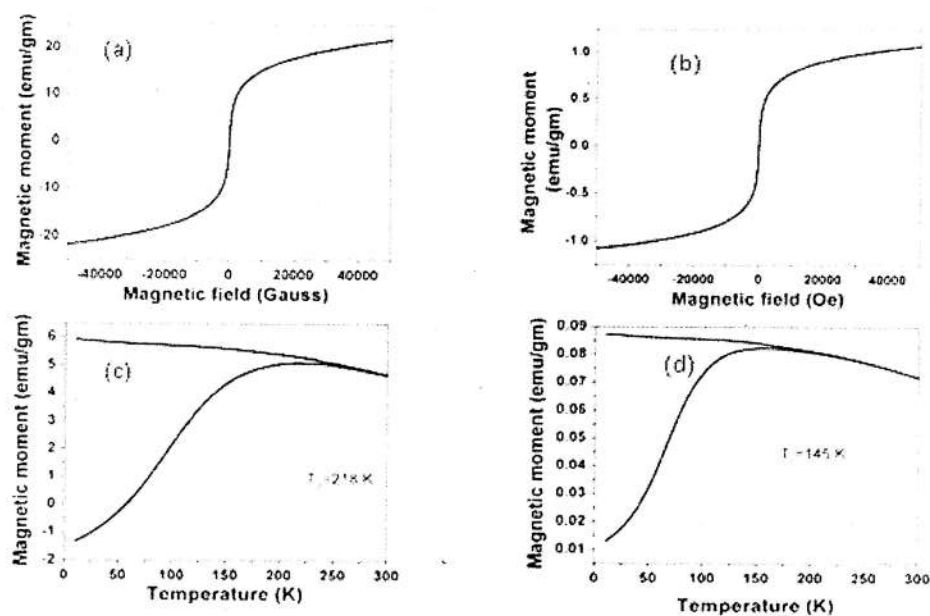


Fig 4. M-H curves of (a) SPION and (b) hybrid at 300 K. M-T curves of (c) SPION and (d) hybrid measured at 500 Oe

Conclusion

In conclusion, hybrid of a new fluorescent dye and SPION in silica matrix is synthesized. Prior to that the, dye developed by a novel approach has been stabilized with CTAB for incorporation in the hybrid which later acts as a structure directing agent. After formation of the hybrid, a novel water extraction method has been employed for removal of CTAB templates resulting in a stable hybrid with radial distribution of the pore channels, ruling out any possibility of leakage of the organic dye from thick silica network. The silica particles are observed to be of size ~ 200 nm with average pore diameter, surface area and volume as 2.4 nm, $68.8 \text{ m}^2/\text{gm}$ and 0.14 cc/gm respectively. The optical property of the dye is found to be almost unaltered after hybrid formation. Also, the fluorescence image of the hybrid corroborates to the bright fluorescent property of the hybrid. Further, magnetic characterization results exhibit the superparamagnetic characteristic of the hybrid. The saturation magnetization as well as T_B have decreased on hybrid formation, which is caused by the silica coating leading to disordered Fe spin near the surface of SPION. This magneto-fluorescent hybrid with porous morphology is having the potential to become an efficient multifunctional agent in biomedical application.

3. Summary & Conclusion

The scientific objectives outlined for this project included development of magnetic nanoparticles, semi-conductor quantum dots and their conjugated binary system. Further it also involved the characterization and physical property optimization of the binary nanosystem and its constituents. In this direction, a set of magnetic nanoparticles and fluorescent materials have been developed. Iron oxide nanoparticles were developed through various synthesis routes eg. mechanical milling and thermochemical routes. The structure property correlation in controlling their magnetic behaviour was revealed. We demonstrated experimentally and theoretically the quantum mechanical behaviour of non-linear magneto-optic Faraday rotation in ferrofluid of ultrafine γ -Fe₂O₃ nanoparticles. The degeneracy of quantum states arising from the projection of magnetic moments of the smaller sized quantum particles in adapting a series of discrete values leads to "Quantized Faraday Effect". The optical property study of Fe₂O₃ nanoparticles synthesized by mechanical milling reveals that not only the surface layer but the interfacial region between the α and γ phases also plays an important role for photoluminescence emission of these nanoparticles in visible light region. A novel bio-conjugate of stearic acid capped γ -Fe₂O₃ nanoparticle with Bovine serum albumin was developed by taking recourse to the fatty acid binding property of the protein. This can also be called as natural anchoring molecule that is functional in several of its biological activities. Then a silica based magnetofluorescent hybrid of a newly synthesized dye and superparamagnetic iron oxide nanoparticles (SPION) with ordered and radially distributed porous structure was developed. A distinct modification in optical and magnetic property is observed due to interaction of the dye and SPION within the silica matrix.


4. Details of New Leads Obtained

The integration of multiple structural components in the so developed hybrid nanosystem results into a potential agent for multifunctional biomedical application and this discovery can be extended for developing newer hybrid nanosystems. The invention "Quantum Faraday Effect" attributed to resonant tunnelling of magnetic moment in case of smaller sized quantum particles is a unique outcome of the project. The new lead in terms of developing a conjugate of nanoparticles with biomolecules by utilising biologically evolved linker moiety

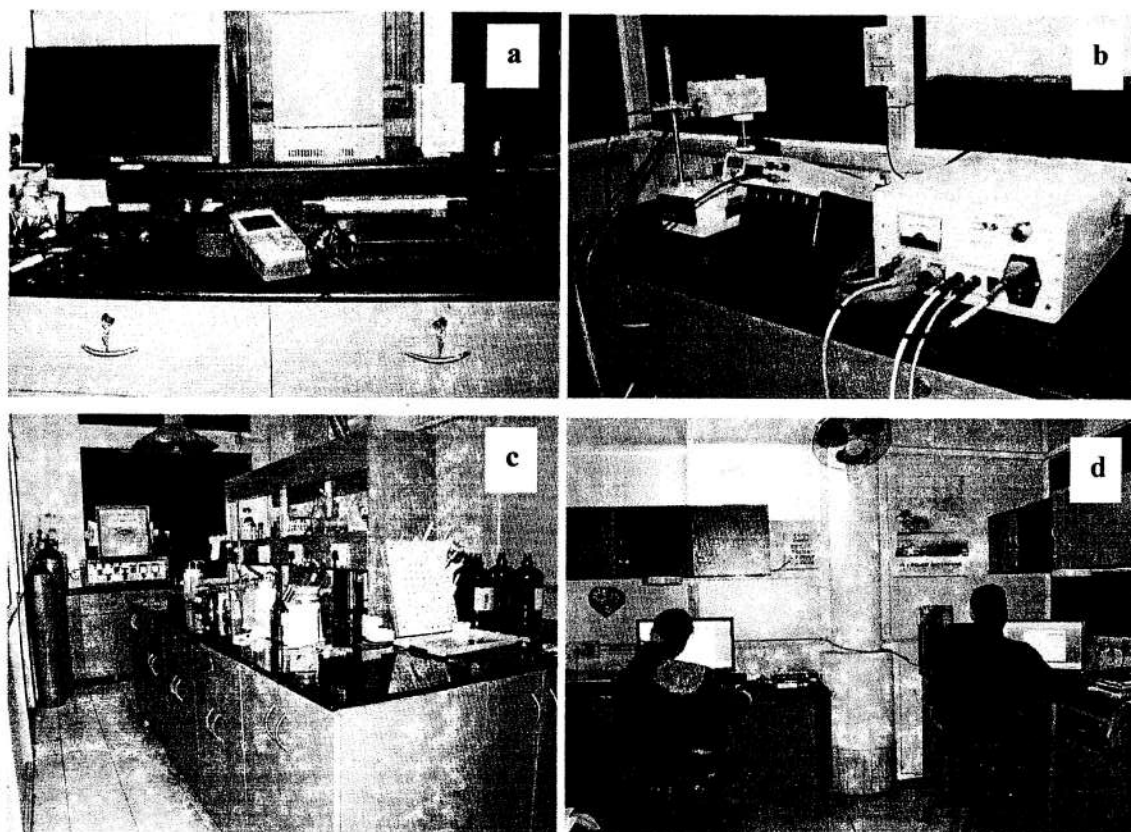
in co-valent fashion is the important achievement of the project and is the first report on conjugation of nanoparticles with biomolecules by utilising the molecular recognition property of biomolecular system. All these new leads were published in reputed international journals or communicated for publication.

5. Consolidated Expenditure Statement

AMOUNT RECEIVED						AMOUNT SPENT						
Year	Equipments	Consumables	Travel	Overhead	Total	Year	Equipments	Consumables	Travel	Overhead	Total	Unspent balance
1	2	3	4	5	6	7	8	9	10	11	12	13
2007-08	890000.00	50000.00	15000.00	0.00	955000.00	2007-08	0.00	0.00	0.00	0.00	0.00	955000.00
2008-09	0.00	0.00	0.00	0.00	0.00	2008-09	84109.00	41930.00	0.00	0	126039.00	828961.00
2009-10	0.00	0.00	0.00	0.00	0.00	2009-10	649957.00	19990.00	24110.00	0.00	694057.00	134904.00
2010-11	700000.00	0.00	0.00	52500.00	752500.00	2010-11	0.00	0.00	0.00	77500.00	77500.00	809904.00
2011-12	0.00	0.00	0.00	0.00	0.00	2011-12	477180.00	0.00	0.00	0.00	477180.00	332724.00
2012-13	0.00	0.00	0.00	0.00	0.00	2012-13	331329.00	0.00	0.00	0.00	331329.00	1395.00
2013-14	0.00	0.00	0.00	0.00	0.00	2013-14	0.00	1395.00	0.00	0.00	1395.00	0.00
Total Rs.	1590000.00	50000.00	15000.00	52500.00	1707500.00		1542575.00	63315.00	24110.00	77500.00	1707500.00	0.00


 P. Deb, Ph.D.
 ASSOCIATE PROFESSOR
 Dept. of Physics
 Tezpur University
 (Centre for Quality)

6. Instruments Procured and Installed



a. Helium-neon laser b. Magnetic susceptibility measurement system c. Synthesis lab
d. Computational facility

FORM- I (2)

(To be submitted in duplicate)

To,


The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085

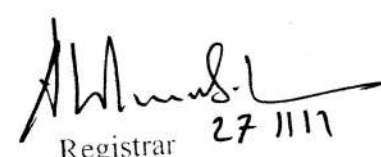
Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 &
2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial assistance
of Rs. 17,07500/- (Rupees seventeen lakh seven thousand five hundred only) for
the year 2007-10 & 2010-11 for the Research Project titled "Synthesis and
characterization of binary nanoparticles: A conjugate of magnetic nanoparticles
and semiconductor quantum dots"

Sir/ Madam,

The terms and conditions of the grant –in-aid communicated by DAE are accepted.

The Demand draft no.766170 dated.4.12.2007 for Rs.9,55,000.00 for the first financial
year 2008-09 and Rs. 7,52,500.00 for the year 2010-11 (Draft no. 329877 dated.
4.6.2010) grant have been received.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar 27/11/17
Tezpur University
Registrar
Tezpur University

FORM- II (Claim Form) (2)

(To be submitted in duplicate by DAE- YSR Awardee/ Grantee Institution)

To,

The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085


Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 and
No.2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial
assistance of Rs. 17,07,500/- (Rupees seventeen lakh seven thousand five
hundred only) for the year 2007-10 & 2010-11 for the Research Project titled
"Synthesis and characterization of binary nanoparticles: A conjugate of
magnetic nanoparticles and semiconductor quantum dots"

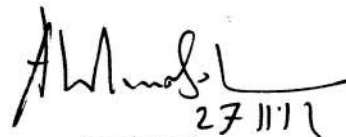
Sir/ Madam,

The terms and conditions of the grant –in-aid communicated by DAE are accepted and an
amount of Rs. NIL is claimed towards expenditure for the project during the current
financial year(2010-11) in accordance with the details given below :

1. Amount received so far	:	Rs. 17,07,500.00
2. Amount spent so far (2010-11)	:	Rs. 77,500.00
3.Amount remaining unspent (2010-11)	:	Rs. 8,09,904.00
4.Amount sanctioned for the current financial year (2010-11)	:	Rs. 7,52,500.00
5. Amount now claimed for the current financial year(2010-11)	:	Rs. NIL

The Demand draft / MT may be drawn in favour of The Registrar, Tezpur University.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


27/11/11
Registrar
Tezpur University
Registrar
Tezpur University

तेजपुर विश्वविद्यालय
(केंद्रीय विश्वविद्यालय)

नपाम, तेजपुर - 784 028, असम, भारत

TEZPUR UNIVERSITY

(A Central University)

Napaam, Tezpur - 784 028, Assam, India

FORM- III

UTILISATION CERTIFICATE (2)

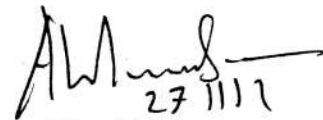
Certified that Grant-in-aid of **Rs.17,07,500.00.**(Rupees seventeen lakhs seven thousand five hundred only) sanctioned by the Government of India, Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Mumbai 400 001 vide their sanction letter no.2007/20/34/04-BRNS/1865 dated. 21.11.2007 and 2007/20/34/04-BRNS/517 dated. 19.5.2010. The previous year balance Rs.1,34,904.00 were available on dated(s).....for the year(2010-11) of which **Rs. 77,500.00**(Rupees seventy seven thousand five hundred only) has been fully utilised/ and there is an un- utilized balance of **Rs.8,09,904.00** of the said grant as on 31.3.2011 has been carried over for utilization during the next financial year 2011-12.



Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University



Finance Officer
Tezpur University
CSD Finance
Tezpur University

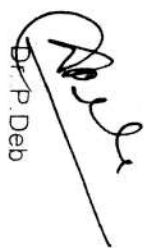


Registrar
Tezpur University
Registrar
Tezpur University

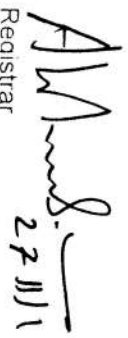
CONSOLIDATED STATEMENT OF ACCOUNTS (2)
Sanction no. 2007/20/34/04/ BRNS

FORM -IV

Year	AMOUNT RECEIVED						Year	AMOUNT SPENT					
	Equipments 2	Consumables 3	Travel 4	Overhead 5	Total 6	Year 7		Equipments 8	Consumables 9	Travel 10	Overhead 11	Total 12	Unspent balance 13
2007-08	890000.00	50000.00	15000.00	0.00	955000.00	2007-08	0.00	0.00	0.00	0.00	0.00	955000.00	
2008-09	0.00	0.00	0.00	0.00	0.00	2008-09	84109.00	41930.00	0.00	0	126039	828961.00	
2009-10	0.00	0.00	0.00	0.00	0.00	2009-10	649957.00	19990.00	24110.00	0.00	694057.00	134904.00	
2010-11	700000.00	0.00	0.00	52500.00	752500.00	2010-11	0.00	0.00	0.00	77500.00	77500.00	809904.00	
Total Rs.	1590000.00	50000.00	15000.00	52500.00	1707500.00		734066.00	61920.00	24110.00	77500.00	897596.00	809904.00	


Dr. P. Deb
DAE - YSR Awardee
Associate Professor
Dept. of Physics
Tezpur University


Finance Officer
Tezpur University


Registrar
Tezpur University
Tezpur

FORM V (2)

Inventory of equipment purchased for the project titled :

“Synthesis and characterization of binary nanoparticles : A conjugate of magnetic nanoparticles and semiconductor quantum dots.”

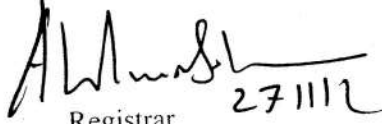
Name of the Institution : **TEZPUR UNIVERSITY , NAPAAM, ASSAM**

- a) DAE sanction no and date : 2007/20/34/04-BRNS/1865 Dated.21.11.2007
2007/ 20/ 34/ 04-BRNS/ 517 Dated. 19.5.2010.
- b) Amount sanctioned for equipment :(Rs. 8,90,000.00+700000.00)= **Rs.15,90,000.00**
- c) List of equipment sanctioned for the project :
1. Pulsed field hysteresis tracer
 2. High field measuring system & AC susceptibility system for high & low temperature
 3. Computational system – PC printer & scanner
 4. Magneto-optic faraday rotation set up
- d) Details of equipment procured :

Sl no	Name of equipment	Date of purchase	Amount	Amount (Included charges)	all Rs.
1	DELL Laptop Computer	29.12.2008	Rs. 63829.00	63829.00	
2	HP colour laser printer	05.09.2008	Rs. 17056.00	17056.00	
3	Offline UPS 1 KVA	31.03.2008	Rs. 3224.00	3224.00	
4	Optical Bread board	5.12.2009	Rs. 64688.00	64688.00	


Dr. P. Deb

DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar
Tezpur University
Registrar
Tezpur University

FORM-1 (3)

(To be submitted in duplicate)

To,


The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085

Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 &
2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial assistance
of Rs. 17,07500/- (Rupees seventeen lakh seven thousand five hundred only) for
the year 2007-10 & 2010-11 for the Research Project titled "Synthesis and
characterization of binary nanoparticles: A conjugate of magnetic nanoparticles
and semiconductor quantum dots"

Sir/ Madam,

The terms and conditions of the grant –in-aid communicated by DAE are accepted.

The Demand draft no.766170 dated.4.12.2007 for Rs.9,55,000.00 for the first financial
year 2008-09 and Rs. 7,52,500.00 for the year 2010-11 (Draft no. 329877 dated.
4.6.2010) grant have been received.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar 271111
Tezpur University
Registrar
Tezpur University

FORM- II (Claim Form) (3)

(To be submitted in duplicate by DAE- YSR Awardee/ Grantee Institution)

To,

The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085

Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 and
No.2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial
assistance of Rs. 17,07,500/- (Rupees seventeen lakh seven thousand five
hundred only) for the year 2007-10 & 2010-11 for the Research Project titled
"Synthesis and characterization of binary nanoparticles: A conjugate of
magnetic nanoparticles and semiconductor quantum dots"

Sir/ Madam,

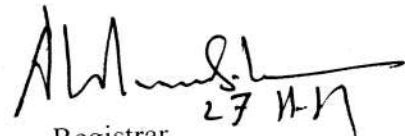
The terms and conditions of the grant –in-aid communicated by DAE are accepted and an
amount of Rs. NIL is claimed towards expenditure for the project during the current
financial year(2011-12) in accordance with the details given below :

1. Amount received so far	:	Rs. 17,07,500.00
2. Amount spent so far (2011-12)	:	Rs. 4,77,180.00
3.Amount remaining unspent (2011-12)	:	Rs. 3,32,724.00
4.Amount sanctioned for the current financial year (2011-12)	:	Rs. NIL
5. Amount now claimed for the current financial year(2011-12)	:	Rs. NIL

The Demand draft / MT may be drawn in favour of The Registrar, Tezpur University.



Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University



Registrar
Tezpur University
Registrar
Tezpur University

FORM- II (Claim Form) (3)

(To be submitted in duplicate by DAE- YSR Awardee/ Grantee Institution)

To,

The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085

Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 and
No.2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial
assistance of Rs. 17,07,500/- (Rupees seventeen lakh seven thousand five
hundred only) for the year 2007-10 & 2010-11 for the Research Project titled
"Synthesis and characterization of binary nanoparticles: A conjugate of
magnetic nanoparticles and semiconductor quantum dots"

Sir/ Madam,

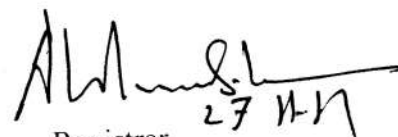
The terms and conditions of the grant –in-aid communicated by DAE are accepted and an
amount of Rs. NIL is claimed towards expenditure for the project during the current
financial year(2011-12) in accordance with the details given below :

1. Amount received so far	:	Rs. 17,07,500.00
2. Amount spent so far (2011-12)	:	Rs. 4,77,180.00
3.Amount remaining unspent (2011-12)	:	Rs. 3,32,724.00
4.Amount sanctioned for the current financial year (2011-12)	:	Rs. NIL
5. Amount now claimed for the current financial year(2011-12)	:	Rs. NIL

The Demand draft / MT may be drawn in favour of The Registrar, Tezpur University.



Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University



Registrar
Tezpur University
Registrar
Tezpur University



तेजपुर विश्वविद्यालय

(केंद्रीय विश्वविद्यालय)

नपाम, तेजपुर - 784 028, असम, भारत

TEZPUR UNIVERSITY

(A Central University)

Napaam, Tezpur - 784 028, Assam, India

FORM- III

UTILISATION CERTIFICATE (3)

Certified that Grant-in-aid of **Rs.17,07,500.00.**(Rupees seventeen lakhs seven thousand five hundred only) sanctioned by the Government of India, Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Mumbai 400 001 vide their sanction letter no. **2007/20/34/04-BRNS/1865** dated. **21.11.2007** and **2007/20/34/04-BRNS/517** dated. **19.5.2010**. The previous year balance **Rs.8,09,904.00** were available on dated(s)for the year (2011-12) of which **Rs.4,77,180.00** (Rupees four lakhs seventy seven thousand one hundred eighty only) has been fully utilised/ and there is an un- utilized balance of **Rs.3,32,724.00** of the said grant as on 31.3.2012 has been carried over for utilization during the next financial year 2012-13.

Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Finance Officer
Tezpur University
600 Flaxton
Tezpur University


Registrar
Tezpur University
27.11.12
Tezpur University


FORM -IV

CONSOLIDATED STATEMENT OF ACCOUNTS (3)
Sanction no. 2007/20/34/04/ BRNS

Year	AMOUNT RECEIVED					Year	AMOUNT SPENT					Unspent balance
	Equipments	Consumables	Travel	Overhead	Total		Equipments	Consumables	Travel	Overhead	Total	
1	2	3	4	5	6	7	8	9	10	11	12	13
2007-08	890000.00	50000.00	15000.00	0.00	955000.00	2007-08	0.00	0.00	0.00	0.00	0.00	955000.00
2008-09	0.00	0.00	0.00	0.00	0.00	2008-09	84109.00	41930.00	0.00	0	126039	828961.00
2009-10	0.00	0.00	0.00	0.00	0.00	2009-10	649957.00	19990.00	24110.00	0.00	694057.00	134904.00
2010-11	700000.00	0.00	0.00	52500.00	752500.00	2010-11	0.00	0.00	0.00	77500.00	77500.00	809904.00
2011-12	0.00	0.00	0.00	0.00	0.00	2011-12	477180.00	0.00	0.00	0.00	477180.00	332724.00
Total Rs.	1590000.00	50000.00	15000.00	52500.00	1707500.00		1211246.00	61920.00	24110.00	77500.00	1374776.00	332724.00


Dr. P. Deb
DAE -YSR Awardee
Associate Professor
Dept. of Physics
Tezpur University


Finance Officer
Tezpur University


Registrar
Tezpur University

FORM - V (3)

Inventory of equipment purchased for the project titled :

"Synthesis and characterization of binary nanoparticles : A conjugate of magnetic nanoparticles and semiconductor quantum dots."

Name of the Institution : **TEZPUR UNIVERSITY , NAPAAM, ASSAM**

- a) DAE sanction no and date : 2007/20/34/04-BRNS/1865 Dated.21.11.2007
2007/ 20/ 34/ 04-BRNS/ 517 Dated. 19.5.2010.
- b) Amount sanctioned for equipment : (Rs. 8,90,000.00+700000.00)= **Rs.15,90,000.00**
- c) List of equipment sanctioned for the project :
- 1.Pulsed field hysteresis tracer
 - 2.High field measuring system & AC susceptibility system for high & low temperature
 3. Computational system – PC printer & scanner
 - 4.Magneto-optic faraday rotation set up

d) Details of equipment procured :

Sl no	Name of equipment	Date of purchase	Amount	Amount (Included all charges) Rs.
1	DELL Laptop Computer	29.12.2008	Rs. 63829.00	63829.00
2	HP colour laser printer	05.09.2008	Rs. 17056.00	17056.00
3	Offline UPS 1 KVA	31.03.2008	Rs. 3224.00	3224.00
4	Optical Bread board	5.12.2009	Rs. 64688.00	64688.00
5	Optical Power Meter	24.1.2010	USD 1152.50	74173.00
6	Magnetic Susceptibility System a) MS2 Meter, MSW Sensor, MS2WFP Power Supply	14.1.2010	UKP 7373.64	585269.00
7	Magnetic Susceptibility System b) MS2 WF Furnace	21.7.2011	UKP 4886.81	403007.00
			Total Rs.	12,11,246.00


Dr. P. Deb

DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar
Tezpur University
Registrar
Tezpur University

FORM-1(2)

FORM- I (4)

(To be submitted in duplicate)

To,


The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085


Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 &
2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial assistance
of Rs. 17,07500/- (Rupees seventeen lakh seven thousand five hundred only) for
the year 2007-10 & 2010-11 for the Research Project titled "Synthesis and
characterization of binary nanoparticles: A conjugate of magnetic nanoparticles
and semiconductor quantum dots"

Sir/ Madam,

The terms and conditions of the grant –in-aid communicated by DAE are accepted.

The Demand draft no.766170 dated.4.12.2007 for Rs.9,55,000.00 for the first financial
year 2008-09 and Rs. 7,52,500.00 for the year 2010-11 (Draft no. 329877 dated.
4.6.2010) grant have been received.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar
Tezpur University
Registrar
Tezpur University

TEZPUR UNIVERSITY

(A Central University Established by an Act of Parliament)

NAPAAM, TEZPUR-784028


DISTRICT : SONITPUR :: ASSAM :: INDIA




FORM- III

UTILISATION CERTIFICATE (4)

Certified that Grant-in-aid of **Rs.17,07,500.00.(Rupees seventeen lakhs seven thousand five hundred only)** sanctioned by the Government of India, Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Mumbai 400 001 vide their sanction letter no. **2007/20/34/04-BRNS/1865 dated.21.11.2007** and **2007/20/34/04-BRNS/517 dated. 19.5.2010**. The previous year balance Rs.3,32,724.00 were available on dated(s)for the year (2012-13) of which **Rs. Rs.3,31,329.00 (Rupees three lakhs thirty one thousand three hundred twenty nine only)** has been fully utilised/and there is an unutilized balance of **Rs.1395.00** of the said grant as on 31.3.2013.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Finance Officer
Tezpur University
Finance Officer
TEZPUR UNIVERSITY


Registrar
Tezpur University
Registrar
Tezpur University

CONSOLIDATED STATEMENT OF ACCOUNTS (4)
Sanction no. 2007/20/34/04/ BRNS

FORM -IV

Year	AMOUNT RECEIVED						Year	AMOUNT SPENT					
	Equipments 1	Equipments 2	Consumables 3	Travel 4	Overhead 5	Total 6		Equipments 8	Consumables 9	Travel 10	Overhead 11	Total 12	Unspent balance 13
2007-08		890000.00	50000.00	15000.00	0.00	955000.00	2007-08	0.00	0.00	0.00	0.00	955000.00	
2008-09		0.00	0.00	0.00	0.00	0.00	2008-09	84109.00	41930.00	0.00	0	126039.00	
2009-10		0.00	0.00	0.00	0.00	0.00	2009-10	649957.00	19990.00	24110.00	0.00	694057.00	
2010-11		700000.00	0.00	0.00	52500.00	752500.00	2010-11	0.00	0.00	0.00	77500.00	809904.00	
2011-12		0.00	0.00	0.00	0.00	0.00	2011-12	477180.00	0.00	0.00	0.00	477180.00	
2012-13		0.00	0.00	0.00	0.00	0.00	2012-13	331329.00	0.00	0.00	0.00	331329.00	
Total Rs.	1590000.00	50000.00	15000.00	52500.00	1707500.00	1542575.00	61920.00	24110.00	77500.00	1706105.00	1395.00		


Dr. P. Deb
DAE -YSR Awardee
Associate Professor
Dept. of Physics
Tezpur University


Finance Officer
Tezpur University
10/10/13
TEZPUR UNIVERSITY


Registrar
Tezpur University
TEZPUR UNIVERSITY

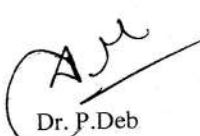
FORM – V (4)


Inventory of equipment purchased for the project titled :
“Synthesis and characterization of binary nanoparticles : A conjugate of magnetic nanoparticles and semiconductor quantum dots.”

Name of the Institution : **TEZPUR UNIVERSITY , NAPAAM, ASSAM**

- a) DAE sanction no and date : 2007/20/34/04-BRNS/1865 Dated.21.11.2007
 2007/ 20/ 34/ 04-BRNS/ 517 Dated. 19.5.2010.
- b) Amount sanctioned for equipment : (Rs. 8,90,000.00+700000.00)= **Rs.15,90,000.00**
- c) List of equipment sanctioned for the project :
- 1.Pulsed field hysteresis tracer
 - 2.High field measuring system & AC susceptibility system
for high & low temperature
 3. Computational system – PC printer & scanner
 - 4.Magneto-optic faraday rotation set up
- d) Details of equipment procured :

Sl no	Name of equipment	Date of purchase	Amount	Amount (Included all charges) Rs.
1	DELL Laptop Computer	29.12.2008	Rs. 63829.00	63829.00
2	HP colour laser printer	05.09.2008	Rs. 17056.00	17056.00
3	Offline UPS 1 KVA	31.03.2008	Rs. 3224.00	3224.00
4	Optical Bread board	5.12.2009	Rs. 64688..00	64688.00
5	Optical Power Meter	24.1.2010	USD 1552.50	74173.00
6	Magnetic Susceptibility System a) MS2 Meter, MSW Sensor, MS2WFP Power Supply	14.1.2010	UKP 7373.64	585269.00
7	Magnetic Susceptibility System b) MS2 WF Furnace	21.7.2011	UKP 4886.81	403007.00
8	Optical Power Meter Accessories : He-Ne Laser with power supply Model.25LHP828-230	23.4.2012	USD 4507.00	255355.00
9	Optical Power Meter Accessories: Power sensor Model: OP-2,VIS/1098313	24.7.2012	USD 990.00	75974.00
			Total Rs.	15,42,575.00


 Dr. P. Deb
 DAE-YSR Awardee
 Associate Professor
 Department of Physics
 Tezpur University


 Registrar
 Tezpur University
 Registrar
 Tezpur University

FORM- I (5)

(To be submitted in duplicate)

To,

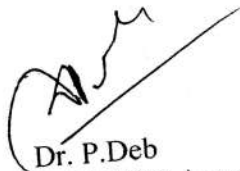
The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085

Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 &
2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial assistance
of Rs. 17,07500/- (Rupees seventeen lakh seven thousand five hundred only) for
the year 2007-10 & 2010-11 for the Research Project titled "Synthesis and
characterization of binary nanoparticles: A conjugate of magnetic nanoparticles
and semiconductor quantum dots"

Sir/ Madam,

The terms and conditions of the grant –in-aid communicated by DAE are accepted.

The Demand draft no.766170 dated.4.12.2007 for Rs.9,55,000.00 for the first financial
year 2008-09 and Rs. 7,52,500.00 for the year 2010-11 (Draft no. 329877 dated.
4.6.2010) grant have been received.



Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University



Registrar
Tezpur University
Registrar
Tezpur University

FORM- II (Claim Form) (5)

(To be submitted in duplicate by DAE- YSR Awardee/ Grantee Institution)

To,

The Programme Officer
BRNS Secretariat
1st floor, Central Complex
BARC , Trombay, Mumbai- 400 085


Sub: Sanction no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 and
No.2007/20/34/04-BRNS/517 dated.19.5.2010 communicating financial
assistance of Rs. 17,07,500/- (Rupees seventeen lakh seven thousand five
hundred only) for the year 2007-10 & 2010-11 for the Research Project titled
"Synthesis and characterization of binary nanoparticles: A conjugate of
magnetic nanoparticles and semiconductor quantum dots"

Sir/ Madam,

The terms and conditions of the grant -in-aid communicated by DAE are accepted and an
amount of Rs. NIL is claimed towards expenditure for the project during the current
financial year(2013-14) in accordance with the details given below :

1. Amount received so far	:	Rs. 17,07,500.00
2. Amount spent so far (2013-14)	:	Rs. 17,07,500.00
3.Amount remaining unspent (2013-14)	:	Rs. NIL
4.Amount sanctioned for the current financial year (2013-14)	:	Rs. NIL
5. Amount now claimed for the current financial year(2013-14)	:	Rs. NIL

The Demand draft / MT may be drawn in favour of The Registrar, Tezpur University.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar
Tezpur University
Registrar
Tezpur University

TEZPUR UNIVERSITY

(A Central University Established by an Act of Parliament)

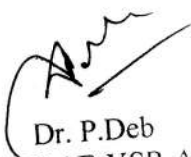
NAPAAM, TEZPUR-784028

DISTRICT : SONITPUR :: ASSAM :: INDIA

FORM- III

UTILISATION CERTIFICATE (S)

Certified that Grant-in-aid of Rs.17,07,500.00.(Rupees seventeen lakhs seven thousand five hundred only) sanctioned by the Government of India, Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Mumbai 400 001 vide their sanction letter no. 2007/20/34/04-BRNS/1865 dated.21.11.2007 and 2007/20/34/04-BRNS/517 dated. 19.5.2010. The previous year balance Rs.1395.00 were available on dated(s)for the year (2013-14) of which Rs. Rs.1395.00 (Rupees one thousand three hundred ninety five only) has been fully utilised and there is an unutilized balance of Rs.0.00 of the said grant.


Dr. P. Deb
DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University



10/10/13
Finance Officer
Tezpur University
TEZPUR UNIVERSITY



10/10/13
Registrar
Tezpur University
Tezpur University


CONSOLIDATED STATEMENT OF ACCOUNTS (5)
Sanction no. 2007/20/34/04/ BRNS

FORM -IV

AMOUNT RECEIVED						AMOUNT SPENT						
Year	Equipments	Consumables	Travel	Overhead	Total	Year	Equipments	Consumables	Travel	Overhead	Total	Unspent balance
1	2	3	4	5	6	7	8	9	10	11	12	13
2007-08	890000.00	50000.00	15000.00	0.00	955000.00	2007-08	0.00	0.00	0.00	0.00	0.00	955000.00
2008-09	0.00	0.00	0.00	0.00	0.00	2008-09	84109.00	41930.00	0.00	0.00	0.00	955000.00
2009-10	0.00	0.00	0.00	0.00	0.00	2009-10	649957.00	19990.00	24110.00	0.00	0.00	828961.00
2010-11	700000.00	0.00	0.00	0.00	0.00	2010-11	0.00	0.00	0.00	0.00	0.00	828961.00
2011-12	0.00	0.00	0.00	52500.00	752500.00	2011-12	0.00	0.00	0.00	77500.00	77500.00	134904.00
2012-13	0.00	0.00	0.00	0.00	0.00	2012-13	477180.00	0.00	0.00	0.00	477180.00	809904.00
2013-14	0.00	0.00	0.00	0.00	0.00	2013-14	331329.00	0.00	0.00	0.00	331329.00	332724.00
Total Rs.	1590000.00	50000.00	15000.00	52500.00	1707500.00		1542875.00	63315.00	24110.00	77500.00	1707500.00	0.00


Dr. P. Deb
DAE -YSR Awardee
Associate Professor
Dept. of Physics
Tezpur University


Finance Officer
Tezpur University


Registrar
Tezpur University

VC VC VC
1 3 2

FORM - V (5)

Inventory of equipment purchased for the project titled :
"Synthesis and characterization of binary nanoparticles : A conjugate of magnetic nanoparticles and semiconductor quantum dots."


Name of the Institution : **TEZPUR UNIVERSITY , NAPAAM, ASSAM**

- a) DAE sanction no and date : 2007/20/34/04-BRNS/1865 Dated.21.11.2007
2007/ 20/ 34/ 04-BRNS/ 517 Dated. 19.5.2010.
- b) Amount sanctioned for equipment : (Rs. 8,90,000.00+700000.00)= **Rs.15,90,000.00**
- c) List of equipment sanctioned for the project :
- 1.Pulsed field hysteresis tracer
 - 2.High field measuring system & AC susceptibility system for high & low temperature
 3. Computational system – PC printer & scanner
 - 4.Magneto-optic faraday rotation set up
- d) Details of equipment procured :

Sl no	Name of equipment	Date of purchase	Amount	Amount (Included all charges) Rs.
1	DELL Laptop Computer	29.12.2008	Rs. 63829.00	63829.00
2	HP colour laser printer	05.09.2008	Rs. 17056.00	17056.00
3	Offline UPS 1 KVA	31.03.2008	Rs. 3224.00	3224.00
4	Optical Bread board	5.12.2009	Rs. 64688.00	64688.00
5	Optical Power Meter	24.1.2010	USD 1552.50	74173.00
6	Magnetic Susceptibility System a) MS2 Meter, MSW Sensor, MS2WFP Power Supply	14.1.2010	UKP 7373.64	585269.00
7	Magnetic Susceptibility System b) MS2 WF Furnace	21.7.2011	UKP 4886.81	403007.00
8	Optical Power Meter Accessories : He-Ne Laser with power supply Model.25LHP828-230	23.4.2012	USD 4507.00	255355.00
9	Optical Power Meter Accessories: Power sensor Model: OP-2,VIS/1098313	24.7.2012	USD 990.00	75974.00
			Total Rs.	15,42,575.00


Dr. P. Deb

DAE-YSR Awardee
Associate Professor
Department of Physics
Tezpur University


Registrar
Tezpur University
Registrar

Tezpur University