SCIENCE AND ART

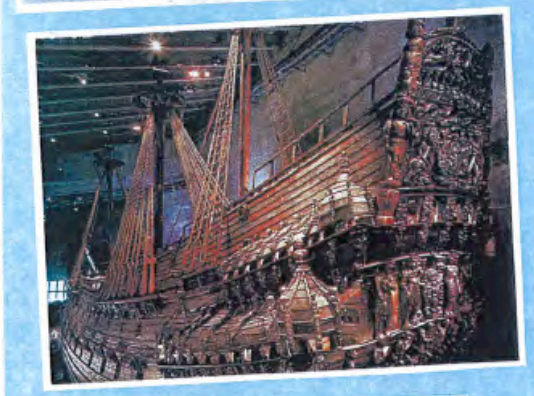
KMF-KTH

Stockholm

Summer Research Program '96

on fun with science and high tech

-An american-swedish team effort among 17-21 yr old boys & girls



The Program

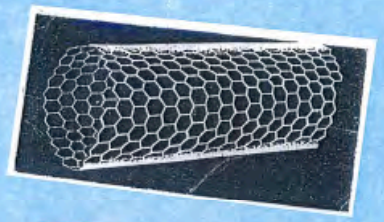
♣♣ For three weeks (June 21 to July 14), eight american, and as many swedish boys & girls between age 17 to 21 yrs, will be given the opportunity to participate in a scientific research summer school at the Royal Institute of Technology in Stockholm, Sweden.

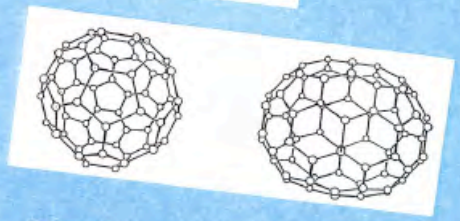
.....are you one of them?

♣♣ In teams of two each, you will work on mainly experimental research programs related to 'high-tech' in order to gain 'hands on experience' with science and technology of topics of high importance today e.g:

- **Energy related Problems**
  High Temperature Superconductors
- **Fast Communications**
  Thin film technology
- **Science on an atomic scale**
  Atomic Force Microscopy, STM...
- **Monitoring Environmental effects**
  Magnetic Sensors
- **Multimedia, animations**
  ..new approach to learning in science..
- *and a few others....you can choose from....*

☺☺ A program is staffed by highly motivated researchers, to promote an intercultural approach to solving problems in science with an emphasis to understand





KTH ↔ *Indian Universities, and Institutes* Research Program

Official National level

DST (*Dept of Science and Technology, India*) (Seetharaman, KTH)

Areas of Research Collaboration:

- **Ground Water Resources**
- **Food (Nutrition) etc.** ***(Gunnar Jack, Prosun Bhattacharya, V.Svetkovic).***
- **Nano-, and Biotechnology** ***(SIDA Project)***
- **Novel Sensors for Environmental Monitoring (SIDA project)**
- **STEELS (Seetharaman, and Rao)** ***Tata Steels, Mittal….***

Education. (*Bi-lateral focused projects*)

IIT's (Kanpur, Delhi, Mumbai,) ; Banaras *(BHU)*; I.I..Sc *(Bangalore)*
Universities at Puné, Bhavnagar, M.S. Univ of Baroda,
JNCASR (Bangalore), NCL (Puné)

KTH –Indian Universities and Institutes Research Program

Universities and Institutes: (RAO)

BHU

Univ of Bhavnagar (SIDA)

M.S. Univ, Baroda

Nano- Biotechnology

JNCASR (Bangalore) (SIDA)

Spintronics, Sensors

I.I. Sc (Bangalore)

Nanotechnology

PUNE (Seetharaman, and Rao)

University of Puné

(Channel to Puné based Swedish Industries)

NCL –National Chemical Labs

Kerala, Coimbatore….

Univ of Cochin etc..

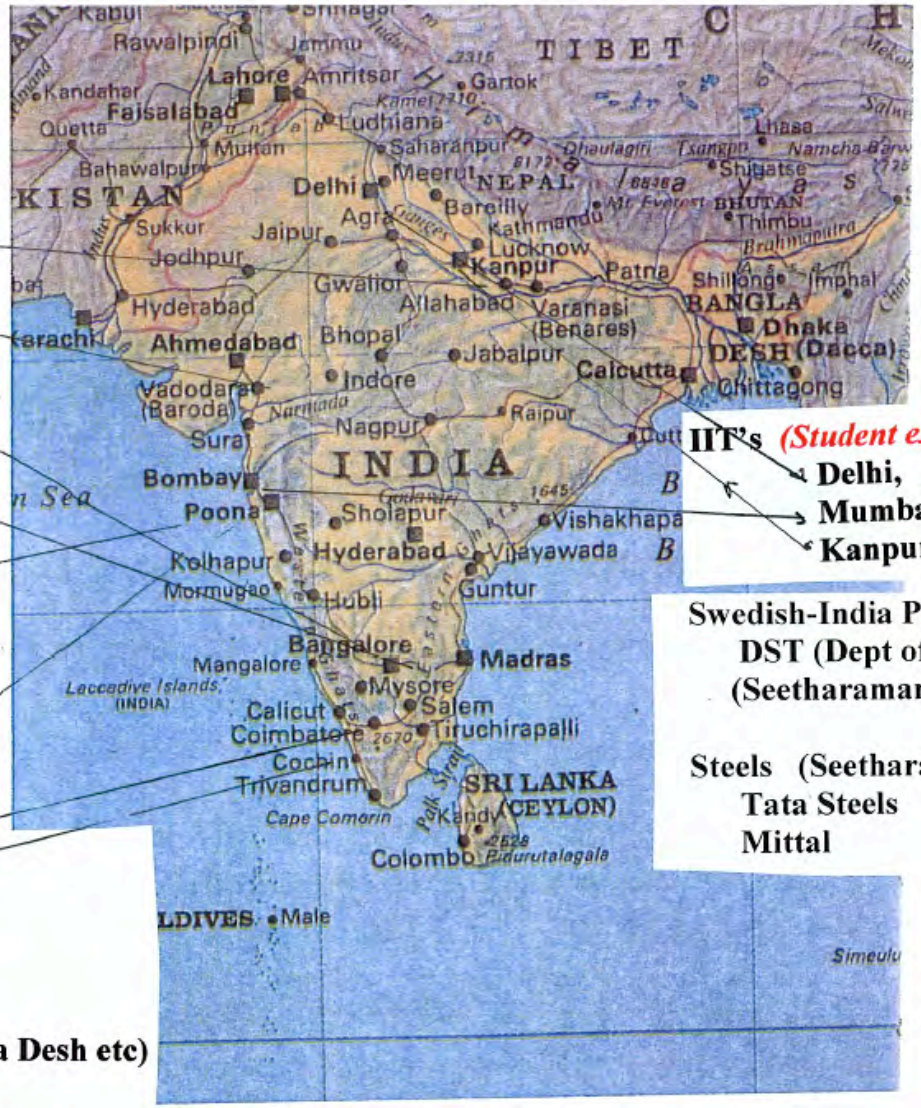
Ground Water Dept.

Food Nutrition,

Gunnar Jack

Prosun Bhattacharya (Bangla Desh etc)

Vladimir Cvetkovic



IIT's ***(Student exchange)***

Delhi,

Mumbai

Kanpur

Swedish-India Programs

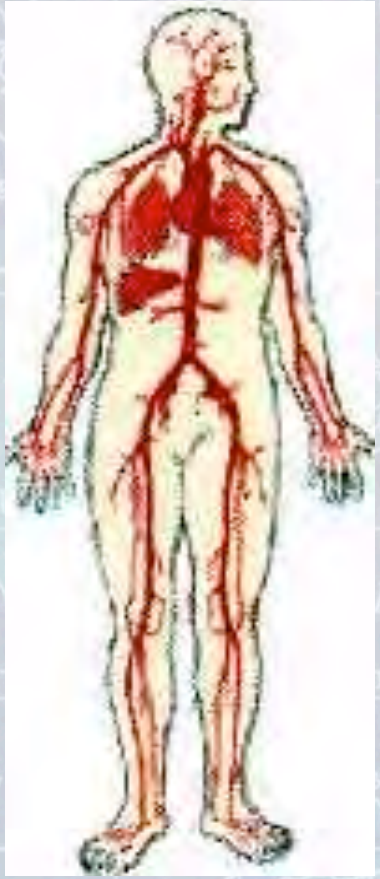
DST (Dept of Science and Tech)

(Seetharaman)

Steels (Seetharaman)

Tata Steels

Mittal



Systemic Drug Delivery

- **High conc. of freely circulating drug.**
- **Low concentration at desired site**

MTC drug delivery

- **High conc. of the drug at the desired site.**
- **A low concentration of freely circulating drug**

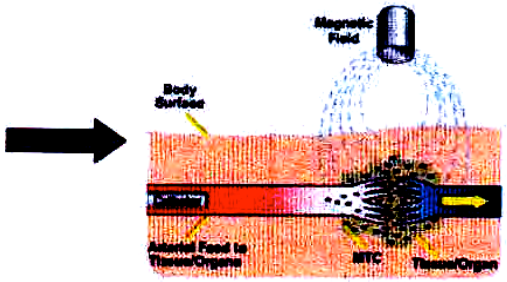
Magnetic nanoparticles for biomedical applications

Currently, we are extensively characterizing superparamagnetic Iron Oxide Nanoparticles. Applications are Targeted Drug Delivery, diagnosis and immunoassays.

A schematic of the targeted drug delivery system

Functionalisation

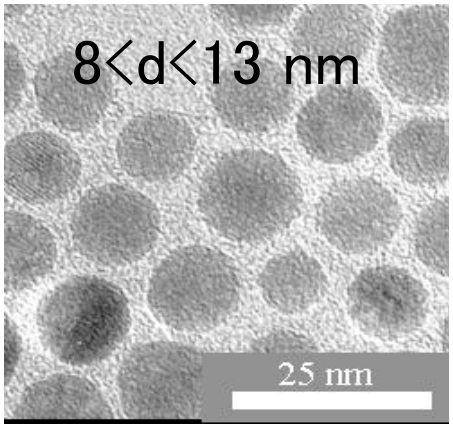
Magnetic nanoparticles can be used as magnetic target carriers (MTC). The MTCs then localize the attached drug through retention in a magnetic field.

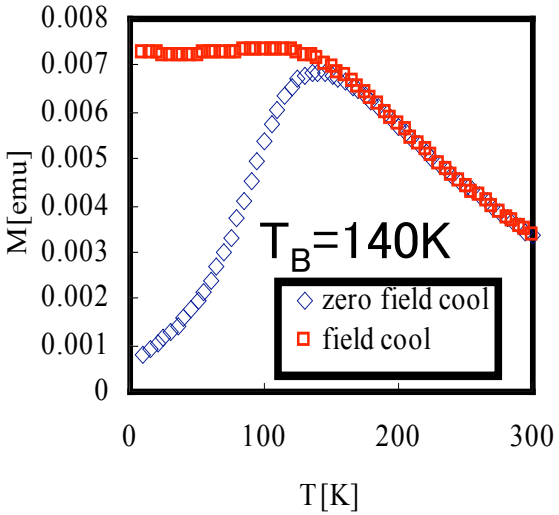


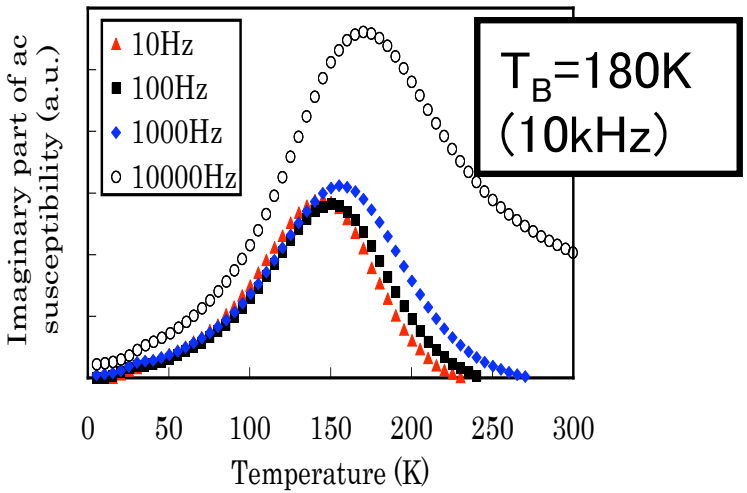
A magnetic field over the site of action pulls the mixture through the artery. The field is removed but the particles are retained in the tumour where the drug is released.

In order to target a drug to a tumour, a catheter is inserted into an arterial feed to the tumour, and MTC mixed with anticancer drug is then introduced into the catheter.

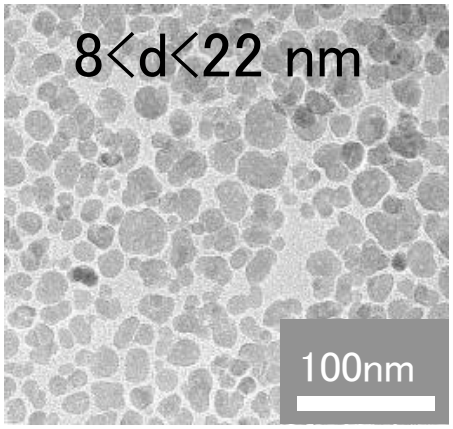
Relationship between particle size and heating rate of magnetite particle

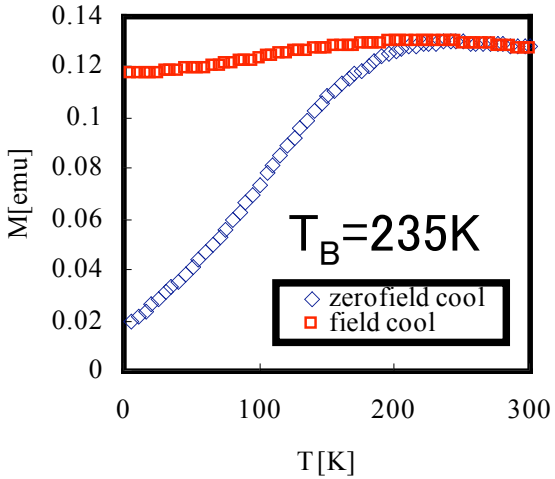


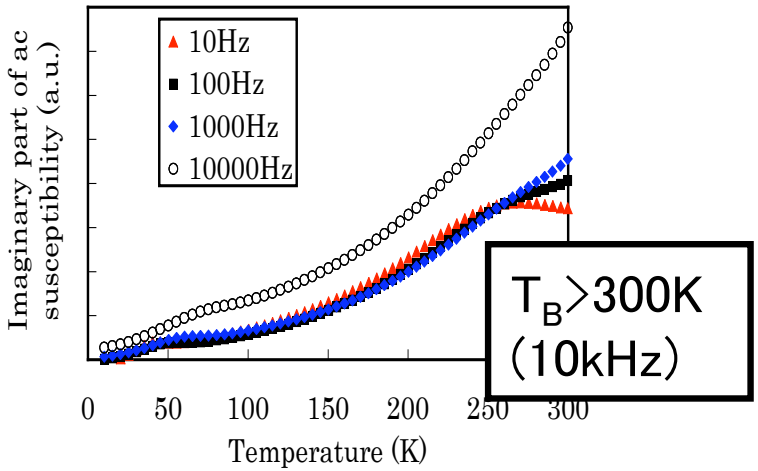




Thermal decomposition method

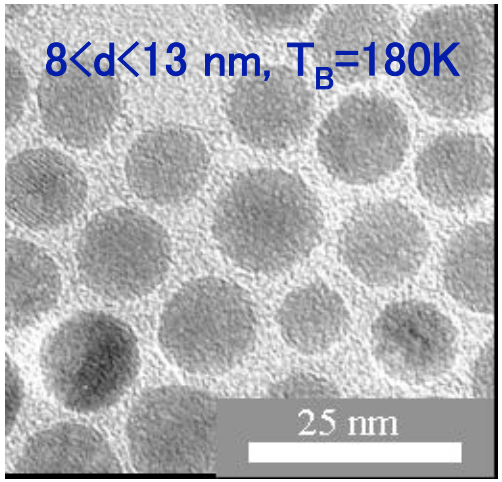




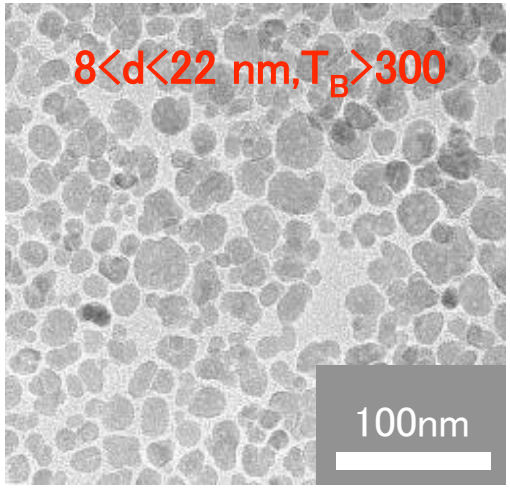


Coprecipitation method

Heat Generation Measurement



Thermal decomposition method



Coprecipitation method

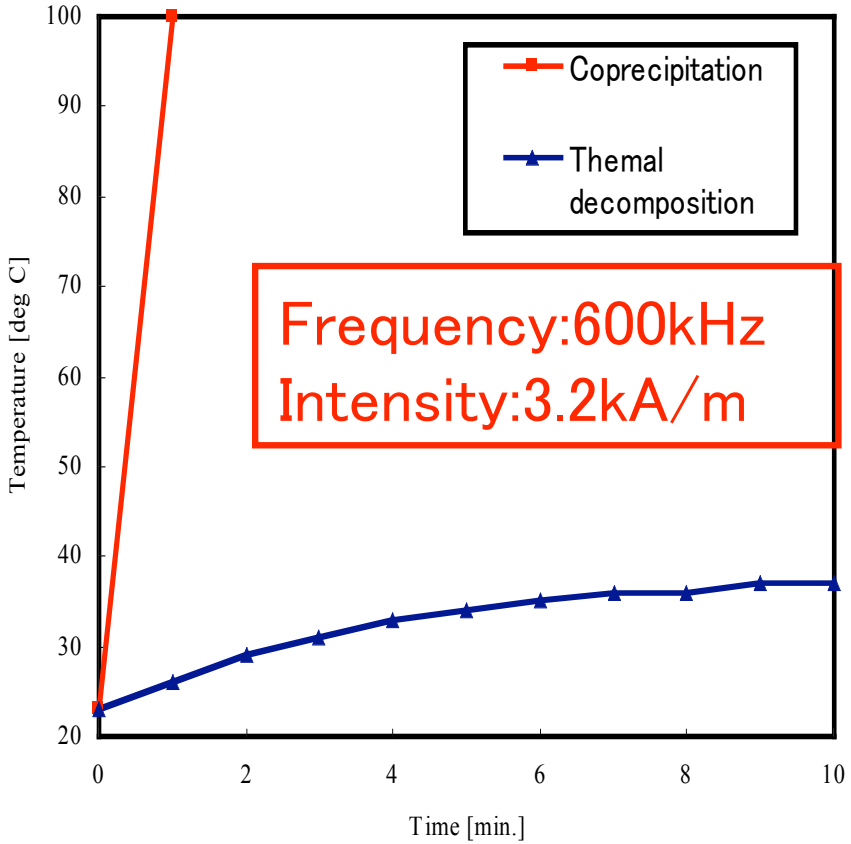


Fig. The result of heat generation measurement of magnetite particles synthesized by coprecipitation method and thermal decomposition method

INSTITUTE OF PHYSICS PUBLISHING NANOTECHNOLOGY

Nanotechnology **17** (2006) 5970–5975 doi:10.1088/0957-4484/17/24/011

Ternary monodispersed $Mn_{0.5}Zn_{0.5}Fe_2O_4$ ferrite nanoparticles: preparation and magnetic characterization

Kinnari Parekh[1,2], Ramesh V Upadhyay[1,3], Lyubov Belova[1] and K V Rao[1,4]

[1] Materials Science–Tmfy-MSE, Royal Institute of Technology, Stockholm, Sweden
[2] Department of Physics, Faculty of Science, The M S University of Baroda, Vadodara, India
[3] Department of Physics, Center for Excellence on Nanotechnology of Nanomagnetic Particles (GUJCOST), Bhavnagar University, Bhavnagar, India

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Abstract

A ternary system of $Mn_{0.5}Zn_{0.5}Fe_2O_4$ has been synthesized for the first time using thermal decomposition of metal acetylacetonate in the presence of a high temperature boiling point solvent and fatty acids. Unlike the results of synthesis of this material by other techniques, we obtain nearly monodispersed nanoparticles, rendering them ideal for applications like in hyperthermia. The crystal structure and morphology of the particles obtained using x-ray diffraction (XRD) and transmission electron microscopy (TEM) are those of a single phase spinel structure with no other impurity phases. The particles are of 7 nm average diameter, with a very narrow (<10%) size distribution. The oleic acid surfactant on the particles shows a 28% weight loss in thermo-gravimetric analyses (TGAs), which corresponds to a monolayer thickness of the coating. Magnetic measurements show the particles to be superparamagnetic with a characteristic blocking temperature of around 50 K.

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Vol. 2 No. 10 October 2003
www.nature.com/naturematerials

MAGNETIC SEMICONDUCTORS The best of both worlds

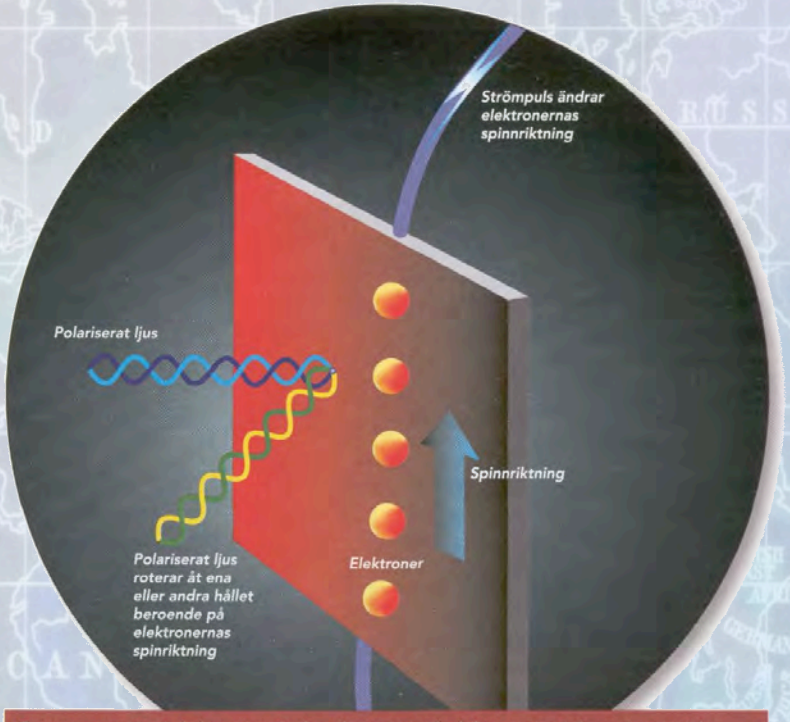
Ferromagnetism above room temperature in bulk and transparent thin films of Mn-doped ZnO

PARMANAND SHARMA[1†], AMITA GUPTA[1], K.V. RAO*[1], FRANK J. OWENS[2], RENU SHARMA[3], RAJEEV AHUJA[4], J. M. OSORIO GUILLEN[4], BÖRJE JOHANSSON[4,5] AND G. A. GEHRING[6]

Films **Bulk** **Transparent thin films**

Mn - 4.56% 2.2% 0%

Spinntronik



Genom en strömpuls kan man ändra riktningen på elektronerna i det spinntroniska materialet och detta fenomen kan utnyttjas för att få materialet att släppa igenom eller stoppa ström. Den spinntroniska transistorn är ett faktum.
Intressant är också att polariserat ljus kan fås att rotera åt olika håll beroende på åt vilket håll elektronerna i det spinntroniska materialet spinner. Detta fenomen kan även utnyttjas för att symbolisera på och av.

Room temperature ferromagnetism in TM (V, Cr, Ti) doped In_2O_3

Amita Gupta, Hongtao Cao, Kinnari Parekh,K.V. Rao*

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Indium oxide is chosen as the host material for doping Ti, V and Cr transition metal ions. Theoretical calculations based on density functional theory (DFT) within a local spin density approximation show that, V-V separation of 5.6 Å is more stable with a strong ferromagnetic coupling. Our calculations clearly predict that substitution of vanadium for indium should yield ferromagnetism in In2O3. Experimentally, (In0.95TM0.05)O3 (TM = Ti, V, Cr) were prepared using sol-gel as well as solid state reaction methods. SQUID Magnetization measurements as a function of field and temperature clearly showed the V and Cr-doped samples are ferromagnetic with Curie temperature well above room temperature. Thin films deposited by pulsed laser ablation using these materials on sapphire substrates exhibit a preferred 222 orientation normal to the plane of the film. The magnetic moment for (In0.95V0.05)O3 film was estimated to be 1.7 μB/V for the film deposited in 0.1 mbar oxygen pressure and is comparable with the theoretical value of

2 μB/V.

***Corresponding Author: rao@kth.se**

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Some Comments to enable a dynamic successful dynamic program

- Active Participation by younger generation is extremely important

  Crowded atmosphere
  Not much opportunities to be left alone except when you are practice YOGA
  Living conditions - amenities vs comfort (summer houses – primitative? How to make it pleasant)
  Cultural differences – Evangelical? Differences do not hinder achievement in India.

- Evaluation of students, researchers, and programmes

  Need a Data base of persons familiar education institutions etc…
  Clear information on limits of economic support, and extra job opportunities

- What does a returning person do?
  We work for ourselves and the system
  Train individuals towards Self improvement,
  own initiative to achieve and outreach will always eventually succeed

- Projects of mutual benefit
  Should be made self supporting within 3 to 4 years.
  Person to person / group to group efforts with least intereference from organization and its beauracracy.