Estimation of Breakdown Strength of Solid Insulating Materials in Liquid Nitrogen

Aejaz Masood, Mujib Ullah Zuberi & Ekram Husain

Department of Electrical Engineering, Z.H.College of Engineering & Technology
Aligarh Muslim University, Aligarh-202002

A simple equation has been proposed using variables predicted by basic theory to predict the dielectric strength of a solid insulating material in liquid nitrogen (LN_2) medium. The equation requires the values of volume resistivity (ρ_v), relative permittivity (ζ_r) and loss tangent ($\tan\delta$) in the medium of liquid nitrogen, which may be obtained easily by low voltage non-destructive measurements. The values of electric strength calculated using this equation for different samples are quite in agreement with the experimentally measured values. It is expected that the equation obtained will help the designers as a handy tool for quick estimation of breakdown voltage of solid dielectrics dipped in LN_2.

Effect of Regenerator Effectiveness on the Performance of Free Piston Free Displacer Stirling Cryocooler

T K Jindal

Aeronotical Dept. , Punjab Engineering College, Chandigarh, India

Regenerator, an important part of the Stirling cryocoolers, is like a thermal sponge alternatively accepting and rejecting heat. In the analysis of cryocoolers, the regenerator is generally assumed to be perfect with effectiveness 1.0. However, the ineffectiveness of the regenerator affects the performance of the cryocooler to a large extent. This paper shows how the regenerator ineffectiveness affects the performance of a cryocooler. A mathematical model developed for free piston free displacer cryocooler with linear motor is applied to an actual cryocooler and the effect of the regenerator effectiveness has been calculated for a set of performance parameters with feasible range.

Turning Studies of Normal Cryogenically Treated P-20 Tungsten Carbide Cutting Tool Inserts

T.V. SreeramaReddy[1], T. Sornakumar[2*], M. VenkataramaReddy[1], B.S. Ajaykumar[1], R. Venkatram [3]

[1]Dept. of Mechanical Engineering, Bangalore Institute of Technology, Bangalore
[2]Dept. of Mechanical Engineering, Thiagarajar College of Engineering, Madurai*
[3]Dept. of Mechanical Engineering, East Point College of Engineering and Technology, Bangalore

Turning studies were conducted on C45 work piece using both untreated and normal cryogenic treated tungsten carbide cutting tool inserts. The turning performance is evaluated in terms of flank wear of the cutting tool inserts, main cutting force and surface finish of the machined work pieces. The flank wear of normal cryogenic treated carbide tools is lower than that of untreated carbide tools on machining of C45 steel. The cutting force during machining of C45 steel is lower with the normal cryogenic treated carbide tools when compared with the untreated carbide tools. The surface finish produced on machining the C45 steel work piece is better with the normal cryogenic treated carbide tools than when produced with the untreated carbide tools.

Performance of trapezoidal axial groove wick heat pipe with nitrogen as working fluid

A. Senthil Kumar and M. Senthil Kumar

School of Mechanical and Building Sciences, Vellore Institute of Technology, Vellore-632 014, Tamil Nadu

This paper deals with development and studies of a trapezoidal axial groove wick nitrogen heat pipe. A special liquid nitrogen cryostat has been designed and developed for evaluating the performance of heat pipe. Experiments have been performed on the heat pipe and on an equivalent diameter solid copper rod. The steady state performance of the heat pipe is compared with that of copper rod.

Modifications for Optimum Operation of Helium Refrigerator

U. Panda, U. Bhunia, A. Mukherjee, T. Maity, N. Datta, J. Parate and R. Dey

Variable Energy Cyclotron Centre, D.A.E., Govt. of India, 1/AF Bidhan Nagar, Kolkata-700064

Modifications in temperature sensors and the control scheme for performance optimisation of Helium Refrigerator are described.

Breakdown of Cryogenic Air under Non-Uniform Fields

Aejaz Masood, Mujib Ullah Zuberi, & Ekram Husain

Department of Electrical Engineering, Z.H.College of Engineering & Technology, Aligarh Muslim University, Aligarh-202002

Measurements were made to assess the ac breakdown voltages in cryogenic air using coaxial cylinder electrode configuration. The results so obtained have been analyzed and correlated using field utilization factor U with earlier reported results under uniform field conditions. Further, this paper attempts to investigate the area and the volume effects on the electrical breakdown strength in cryogenic air so as to obtain better design of electrical insulation for high temperature superconducting apparatus. The investigation revealed that breakdown strength of cryogenic air degraded as the 90% stressed electrode area $(SEA)_{90}$ & 90% stressed liquid volume $(SLV)_{90}$ was increased confirming that the area & volume effects cause degradation of breakdown strength in cryogenic air.

Field induced first order antiferromagnetic to ferromagnetic transition in Al-doped $CeFe_2$: a calorimetric investigation

L.S. Sharath Chandra, K. Mukherjee, V. Ganesan, A. Banerjee and P. Chaddah

UGC-DAE Consortium for Scientific Research (CSR), University Campus, Khandwa Road, Indore 452017, India.
and
M.K. Chattopadhyay and S.B. Roy

Magnetic and Superconducting Materials Section, Centre for Advanced Technology, Indore 452013, India.

Field variation of heat capacity at fixed temperatures is investigated to identify the origin of the field induced first order phase transition in polycrystalline $Ce(Fe_{0.094}Al_{0.04})_2$ sample. The heat capacity at 4.5 K and 3.5 K shows hysteresis in different field cycles and the virgin curve stays outside the envelope curve. This is analogous to the magnetization and magneto-resistance behavior observed in this system, where the amount of hysteresis, and the magnitude of zero-field irreversibility are attributed to the degree of supercooling/superheating, and the extent of kinetic arrest of the reverse transition from ferro- to antifrromagnetic state in field reducing cycle respectively. However, contrary to the magnetization and magneto-resistance, in heat capacity both these features have decreased with reducing temperature signifying the importance of structural contribution.

Low temperature properties of Gd_5Ge_4

L. S. Sharath Chandra, Swati Pandya, P. N. Vishwakarma, Deepti Jain, and V. Ganesan

UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Raod, Indore 452 001

Here we report resistance (R), magnetization (M), heat capacity (C), and thermopower (S) on Gd_5Ge_4 at low temperatures and high magnetic fields. The Gd_5Ge_4 is antiferromagnetic down to lowest temperatures in zero magnetic field with T_N ~ 127K. Below T_N, application of certain magnetic field, which is dependent on temperature, results in ferromagnetism. This transition is reversible above 20K, partially reversible in the temperature range 10K < T < 20K and completely irreversible below 10K. The irreversibility of this antiferromagnetic to ferromagnetic transition below 20K is associated with arrest of kinetics due to appearance of the glassy phase. We discuss the results in light of available phase diagrams.

Influence of magnetic field on the nature of ferromagnetic to paramagnetic phase transition in $Sm_{0.52}Sr_{0.48}MnO_3$

P. Sarkar[1], P. Mandal[2], L. S. Sharath Chandra[3], V. Ganesan[3], A. K. Bera[4], and S. M. Yusuf[4]

[1]Department of Physics, Serampore College, Serampore 712 201, India
[2]Saha Institute of Nuclear Physics, 1/AF Bidhannagar, Calcutta 700 064, India
[3]UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452 017, India
[4]Solid State Physics Division, Bhabha Atomic Research Centre, Mumbai 400 085, India

We report on the magnetic field dependence of the order of the ferromagnetic to paramagnetic phase transition of $Sm_{0.52}Sr_{0.48}MnO_3$ single crystal from magnetic and specific heat studies. We observe a first order ferromagnetic transition with thermal hysteresis in magnetization, and sharp, symmetric and narrow specific heat peak for magnetic field below 4T while the phase transition becomes essentially second order above that field. This unusual behavior of magnetic phase transition has been explained in terms of competition between the lattice strain due to the ionic size mismatch and the magnetic field, which enhances the fluctuations of the magnetic order parameter.

Low temperature high magnetic field studies on Ti substituted $BiMn_2O_5$ multiferroic

D. K. Shukla[1,*], Ravi Kumar[2], S. Mollah[1], P.N.Vishwakarma[3], V. Ganesan[3] and A. Banerjee[3]

[1]Department of Physics, Aligarh Muslim University, Aligarh 202 002, India.
[2]Inter University Accelerator Centre, P.O. Box 10502, Aruna Asaf Ali Marg, New Delhi 110 067, India.
[3]UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452 017, India.
[*]Corresponding author: shukladk@gmail.com

The effect of Ti substitution on the multiferroic properties of $BiMn_2O_5$ system have been studied by the means of structural, dielectric, magnetic and heat capacity measurements. Our study shows that with Ti substitution low temperature antiferromagnetic (AFM) ordering (T_N~39 K) is weakening and ferroelectric transition (T_C~35 K) is lost, whereas new dielectric (at ~ 120 K) and magnetic (at ~ 86 K) anomalies have been observed in dielectric and magnetic characterization and verified by heat capacity measurements done in the presence of magnetic fields up to 14 T.

Magnetic and electrical transport properties of Ce substituted perovskite oxides $La_{1-x}Ce_xMnO_3$

M.P. Sharma, Anjali Krishnamurthy, Bipin K. Srivastava, Swati Pandya[#] and V. Ganesan[#]

Department of Physics, University of Rajasthan, Jaipur – 302 004
[#]UGC-DAE Consortium for Scientific Research, Indore – 452 017
E-mail: mps.phy@gmail.com

Magnetic and electrical transport studies have been made on cerium substituted $La_{1-x}Ce_xMnO_3$ perovskites for x = 0.05, 0.10, 0.20 and 0.30 (referred to as LCeM05 etc.) prepared following sol gel method. Magnetization measurements are reported in the temperature range 20K – 300K and in fields upto 8 kOe. Electrical resistance has been measured in the temperature range 2K – 300K and in fields upto 14T. The samples undergo paramagnetic to ferromagnetic transition. LCeM05 is a rather disordered FM; others are better ordered. Substitution of only 5 atomic% of Ce for La enhances the FM exchange and also the magnetic moment. Then the moments remain about the same till substitution by 20 atomic% Ce but somewhat reduce for 30 atomic% substitution. All the four samples are soft FMs. The samples undergo insulator – metal (I – M) transitions at temperatures lower than those of magnetic transitions. With increasing field I – M transition temperatures increase. In all the samples an upturn is seen in resistivity at ~25K. The electric transport behaviour is explained in terms of inter-granular tunneling and the effect of field on the same. In insulating region the conduction is controlled by small polaron hopping mechanism. Values of activation energy are identical to those reported in other substituted manganites.

Grain Growth Dependent Transport and Magnetotransport of Nanostructured $La_{0.7}Pb_{0.3}MnO_3$ Manganites

P.S. Solanki*, R.R. Doshi*, Swati Pandya, V. Ganesan** and D.G. Kuberkar***

**Department of Physics, Saurashtra University, Rajkot - 360 005*
***UGC-DAE CSR, Indore - 452 017*

In this communication, we report the effect of grain growth modifications on the transport and magnetotransport of Sol-Gel grown polycrystalline $La_{0.7}Pb_{0.3}MnO_3$ (LPMO) manganites sintered at various temperatures. The structural studies using Rietveld refinement of the XRD data confirms single phasic nature of the samples while the AFM investigations show the development of secondary grains in the sample sintered at 1000^{o}C. The effect of secondary grains on the transport and magnetotransport properties becomes prominent in the samples sintered at 1050^{o}C and above. The temperature dependent MR behavior of all the LPMO samples sintered at various temperatures has been understood in the light of modifications in their microstructural properties.

A Novel Solution Combustion Method for the Synthesis of CMR Material $La_{1-x}Sr_xMnO_3$

S. T. Bendre[+], P. B. Patil, P. P. Jagtap

Department of Physics, North Maharashtra University, P.B.No. 80, Jalgaon-425 001, India.
[+]*e mail:* bendre_st@rediffmail.com
Swati Pandya, L.S.Sharath Chandra, Deepti Jain, D.M.Phase and V.Ganesan

UGC-DAE Consortium for Scientific Research, Khandwa Road, Indore-452017, India.

A novel solution combustion method (SCM) is reported here for the synthesis of CMR materials like $La_{1-x}Sr_xMnO_3$. The present method based on the chemical combustion technique can be easily carried out in a simple laboratory environment. Materials thus synthesized are characterized by x-ray diffraction, magneto resistance and microscopy techniques. XRD analysis shows that the samples are of reasonable phase purity. Magnetoresistance measurements down to 2K and magnetic fields up to 14T reveals a shift in the Metal-Insulator transition from 234K in Zero field to ~274K at 14T, with a substantial change in MR with 14T. No significant change is seen in heat capacity measurements for both 0T and 14T which can be attributed to the broadening of the T_{MI}. This is further supported by the microscopy measurements like SEM and AFM that clearly reveals formation of agglomerated nano-sized particles that are ~30-100nm with a wide particle size distribution. Results are discussed in the light of above said measurements as well as other supporting characterizations.

Crystallization of $Sr_x Ba_{1-x} (NO_3)_2$ Solid Solutions from Aqueous solution and determination of Debye Temperature from the Heat Capacity measurements

P.M.Kumar[1], K.A.Hussain[1] P.N.Viswakarma[2]. L.S.Sharath Chandra[2] and V. Ganesan[2]

[1]Department of Physics, Kakatiya University, Warangal, India .-506 009
[2]UGC-DAE Consortium for Scientific Research, Campus, Khandwa Road, Indore, India – 452 001

A series of $Sr_xBa_{1-x}(NO_3)_2$ crystals have been grown from aqueous solution with different Sr^{+2}/ Ba^{+2} ratios (x=0 to 1). These crystals were characterized by powder X-ray diffraction. Almost all the peaks are indexed with a simple cubic structure. The variation of lattice constants with the concentrations of Ba^{+2} follows the Vegard's law. Heat Capacities were measured in the temperature range from 2K- 300K. Debye temperatures are estimated from x-ray diffraction and heat capacity measurements and are compared.

Microstructure and magnetic properties of nanoparticles of cobalt doped ZnO

Chandana Rath[1,*], P. Mallick[2], Alok Banerjee[3], N.P. Lalla[3] and N.C. Mishra[4]

[1]School of Materials Science & Technology, Institute of Technology, Banaras Hindu University, Varanasi 221005, India.
[2]Department of Physics, North Orissa University, Baripada 757003, India
[3]UGC-DAE Consortium for Scientific Research, Khandwa Road, Indore 452017, India
[4]Department of Physics, Utkal University, Bhubaneswar 751004, India
E-mail: chandanarath@yahoo.com

We report synthesis of self organized nanoparticles of size ~20-30 nm by co-precipitation technique. Co addition in ZnO matrix leads to the reduction in crystallite size and modifies their morphology. At 5 at.% Co, the particles are highly textured and show nearly rectangular shape (TEM). Increasing Co to 10 at.%, results into self organization of the particles in a line looking like nanofibers. This alignment of particles increases by increasing the Co content further. Magnetic studies reveal that the carrier mediated ferromagnetism is absent down to 10 K.

Microscopic and magnetic characterization of Fe_3O_4-ZnO nanocomposites

Samrat Mukherjee[1] and Dipankar Das[2]

[1]Dept. of Applied Physics, BIT Mesra, Ranchi 835215, India
[2]UGC-DAE, CSR, Kolkata Centre, III/LB 8, Salt Lake, Kolkata 700098, India
Corresponding author's e-mail: ddas@alpha.iuc.res.in

Nanocomposites of magnetite in ZnO matrix have been synthesized by a chemical route. The mole fraction of magnetite in the composites was varied between 10 to 30 %. The nanocomposites were checked for their phase purity by x-ray diffraction and their sizes were estimated through transmission electron microscopy. Ac susceptibility of the samples were measured as a function of temperature and frequency and superparamagnetic blocking temperatures were estimated. Field cooled and zero-field cooled magnetization studies were also carried out which established that the superparamagnetic blocking temperature of the nanocomposites increased with increasing mole fraction of magnetite. Mössbauer spectroscopic measurements support the results of magnetization studies.

Effect of Fe and Co doping on the structural and magnetic properties of NiO

P. Mallick, Chandana Rath, R. Biswal, A. Banerjee and N. C. Mishra

[1]Department of Physics, North Orissa University, Baripada 757 003 India
[2]School of Material Science & Technology, Institute of Technology, BHU, Varanasi 221 005 India
[3]Department of Physics, Utkal University, Bhubaneswar 751 004 India
[4]UGC-DAE Consortium for Scientific Research, Khandwa Road, Indore 452017 India

The structural and magnetic characteristics of $Ni_{1-x}A_xO$ (A = Fe, Co) samples prepared by chemical co-precipitation and post thermal decomposition method are reported. XRD revealed formation of impurity phases beyond x = 0.02 for Fe doping and no impurity phases were detected up to x = 0.05 for Co doped NiO. The samples exhibit FCC structure of the parent NiO for all doping either by Fe or Co. Temperature dependence of ZFC and FC magnetization shows that the antiferromagnetic (AF) NiO becomes ferromagnetic even at a low concentration Fe (~1 at.%) with a $T_c \geq 350K$ whereas Co doping weakens AF ordering in NiO and induces magnetic hysteresis loop for x = 0.05 at 10 K. The mechanism of the observed magnetic behaviour is explained on the basis of hole-mediated magnetic ordering in the weakened AF order arising due to defects and defect clusters in the doped NiO matrix.

Magnetic study on Ni-Zn ferrite nanosystems using VSM

Jeevan Job Thomas and Nandakumar Kalarikkal*

School of Pure & Applied Physics, Mahatma Gandhi University, Kottayam, Kerala-686 560

In this paper we report the results of the magnetic study performed on sol-gel derived $Ni_{1-x}Zn_xFe_2O_4$ nanosystems. There is a gradual decrease in saturation magnetization as the Zn^{2+}ion content increases. The observed result is attributed to the occupation of Zn^{2+}ions in the tetrahedral (A) site dislocating the Fe^{3+}ions to the octahedral (B) site, thereby weakening the I_{AB} superchange interaction and alterations of the parallel orientations of magnetic moments in the (B) network of the spinel structure.

Magnetic Properties of Cobalt Nanoparticles of Various Shapes

D. Srikala[†], A. Banerjee[‡] and S. Patnaik[†]

[†] School of Physical Sciences, Jawaharlal Nehru University, New Delhi 110067, India
[‡] UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road, Indore 452017, India

We report the synthesis and magnetic characterization of cobalt nanoparticles with different shapes and sizes prepared by rapid pyrolysis of cobalt carbonyl. The shapes that we have achieved include spherical, cube, and a combination with disc. Temperature dependent magnetization showed persistence of ferromagnetism above room temperature for cubic and spherical particles. The cubic nanoparticles showed negligible coercive field at T = 10 K and size dependent magnetic properties. Oxidized spherical nanoparticles of diameter 14.5 nm showed strong ferromagnetic behavior at 5 K with pronounced exchange bias which varied with the antiferromagnetic shell and strong temperature dependent magnetization.

A Magnetic Study on Mn^{2+} doped CdS Nanoparticles Using Vibrating Sample Magnetometer

Rajeev. R. Prabhu [1] and M. Abdul Khadar [1, 2, *]

[1]Department of Physics and [2]Center for Nanoscience and Nanotechnology
University of Kerala, Kariavattom P.O, Thiruvananthapuram – 695 581, India.
***** *Corresponding author e-mail ID: mabdulkhadar@rediffmail.com*

Diluted magnetic semiconductors (DMS) is a key group of materials that has attracted intense scientific and technological interest in recent years. We have synthesized nanoparticles of $Cd_{1-x}Mn_xS$ ($x \leq 0.3$) by arrested precipitation technique. X-ray diffraction studies are carried out to determine the crystal structure and grain size of the samples. The particle size of the samples as observed from HRTEM images is ~4 nm. High field magnetization measurements on nanoparticles of $Cd_{1-x}Mn_xS$ are carried out at room temperature (300 K) and at 10 K. The magnetization curves exhibit neither hysterisis nor remenence indicating that the samples are superparamagnetic.

Chemical Synthesis and Magnetic Properties of Single-crystalline $La_{0.67}Ca_{0.33}MnO_3$ Nanoplates

Debasis De[1,2], Shanker Ram[2*], Alok Banerjee[3], Ajay Gupta[3], and Sanat K. Roy[1]

[1]Department of Metallurgical and Materials Engineering, Indian Institute of Technology, Kharagpur 721 302
[2]Materials Science Centre, Indian Institute of Technology, Kharagpur 721 302, India
[3]UGC-DAE Consortium for Scientific Research, Indore centre, Indore 452 017, India
**Corresponding author: sram@matsc.iitkgp.ernet.in*

A novel chemical method with small polymer templates is explored to obtain single-crystalline $La_{0.67}Ca_{0.33}MnO_3$ in form of thin nanoplates of 15-36 nm thickness. Such thin platelets of this compound represent single magnetic domain particles. At low temperature (10 K), as large coercivity H_c as 411 Oe has been obtained in sample heated at 600ºC in air for 2 h. The H_c - value decreased readily to 143 or 36 Oe on increasing average crystallite size from 15 nm to 18 or 35 by heating at higher temperature (800 or 1000ºC) for 2 h. Saturation magnetization has increased to be 30.7, 86.7, or 91.1 emu/g in platelets heated at 600, 800, or 1000ºC respectively. A sharp Curie point occurs around 268 K with a small spin flipping at ~ 40 K in the last two samples. The results are described in correlation to the microstructure.

XANES, Magnetic and Magnetotransport studies of $LaMn_{1-x}Co_xO_{3\pm d}$

Palikundwar Umesh A.,[a,*] Sapre V. B.,[a] Moharil S. V. [a] and Priolkar K. R [b]

[a] Department of Physics, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur-440033, India
[b] Department of Physics, Goa University, Goa-403206, India

The structural, XANES, magnetic and magnetotransport studies are carried out on $LaMn_{1-x}Co_xO_{3\pm\delta}$ ($0\leq x\leq 1$). The compounds prepared by aqueous solution method under similar synthesis conditions crystallize with perovskite structure, in rhombohedral phase with space group, R-3C for $0\leq x\leq 0.2$ and $0.6\leq x\leq 1$ and in orthorhombic phase with space group, Pbnm for 0.3d"xd"0.5. The pseudocubic lattice parameters slightly expand in Mn rich region ($x\leq 0.5$) and contract linearly with Co content in Co rich region ($x>0.5$). XANES data show that the cobalt enters in equal amount as Co^{2+} and Co^{3+} in Mn rich region and as Co^{3+} in large amount in Co rich region. Despite of the δ, Co and Mn are in mixed valence states in the entire range of substitution and show gradual increase towards higher valence state in Co rich region. The ferromagnetism in the compounds is mainly due to the double exchange Mn^{3+}-O- Mn^{4+} mechanism in Mn rich region and the average result of mixed interactions in Co rich region. The insertion of Co results in the reduction of ferromagnetic ordering as well as magnetoresistance in both the regions. The lower value of room temperature resistivity at either ends of the compounds is due to the p type of conductivity at Mn end and n type of conductivity at Co end.

A Facile Route to Design Polyvinyl alcohol Based Superparamagnetic Nanocomposites

A.K. Bajpai* and Rashmi Gupta

Bose Memorial Research Laboratory, Department of Chemistry, Government Autonomous Science College, Jabalpur (M.P.) – 482001, India

In recent past, magnetic nanocomposites have shown promise in potential biomedical applications due to their superparamagnetic nature. They have also established themselves as a promising class of hybrid organic-inorganic materials derived from polymers and organic/ inorganic fillers. In the present study biocompatible nanocomposites were prepared by in-situ synthesis of magnetic nanoparticles within the polyvinyl alcohol-grafted-polymethyl methacrylate (PVA-g-PMMA) hydrogels and characterized by techniques such as SEM, TEM, XRD and VSM. The magnetic behavior of nanocomposites and bulk magnetite particles was studied under varying applied magnetic fields and their superparamagnetic property was examined.

Nano-inclusions of Y-211 in high temperature superconductor YBCO

Nitu Badera*, S.B.Srivastava*, Swati Pandya#, L.S.Sharath Chandra#, Deepti Jain# and V.Ganesan#

**School of studies in Physics, Vikram University, Ujjain (M.P.) India-456010*
 # UGC-DAE Consortium for Scientific Consortium, Khandwa Road, Indore (M.P.) India-452017

Effect of nano-inclusions of Y_2BaCuO_5 (211) insulating precipitates on the critical current density of high temperature superconductor $YBa_2Cu_3O_{7-x}$ (123) has been investigated. Quench and Melt Growth (QMG) technique has been employed to prepare the super-conducting composite. Micrographic investigation of the sample using Atomic Force Microscopy (AFM) shows a well-aligned 123 matrix in which 211 precipitates of mean size 115nm are embedded in a uniform fashion. Critical current measurements as a function of temperature in zero field shows a resistive index 'n' that is as high as 20 at 40K. Critical current (J_c) measurements in the presence of magnetic fields (B) have two components and the pinning force (J_c x B) follows a functional form $Fp \propto h^P (1-h)^q$ with q=2 and p~1, where $h = B/B_o$, as expected for a superconductor that has saturated pinning properties.