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RESEARCH ARTICLE

ANALYSIS OF CRITICAL TEMPERATURE IN BI-2223 SYSTEM

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ABSTRACT

In the present work, the composition Bi2Sr2Can-1CunOx were prepared by solid state reaction of more purity metals with Fe2O3 doping. The critical temperature Tc of the high temperature superconducting cuprate Bi¬2Sr4-xCaxFe3-yCuyOz were obtained 157K. On this temperature, The Resistance of the sample is going to zero. We have study in the paper about Electrical Resistant at 157K temperature of the samples.

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1. INTRODUCTION

Superconductivity is a property where by a material loses all resistance to the flow of electrons. This property was first discovered by H. K. Onnes in 1911 (Kamerlingh Onnes, 1911). The Bi–Sr–Ca–Cu–O (BSCCO) system has three superconducting phases in terms of its chemical compositions, Bi-2201, Bi-2212 and Bi-2223. The Discovery of the Bi-Sr-Ca-Cu-O superconducting compounds by Maeda et al in 1988 (Maeda *et al.,* 1988). In the generation of a superconductor not only shows zero resistance, but also gives a magnetic field and adopt the Meissner effect Uchida and Takugi et al (Uchida *et al.,* 1987; Takagi *et al.,* 1987; Ozturk *et al.,* 2007; Terzioglu *et al.,* 2008).

The common method synthesize these superconducting oxides was used to the solid state reaction method with Bi-2223 superconductor in $Bi_2Sr_{4-x}Ca_xFe_{3-y}Cu_yO_z$ with (x=0.0, 1.0…) concerned by H.S.singh and Rohitash kumar in 2013 (Singh and Rohitash kumar, 2013). We can use the different compounds for superconductors types Bi_2O_3, $SrCO_3$, $CaCO_3$ and CuO. We can characterization of the material as XRD, FTIR, Mossbauer effect and particle analysis etc. Our main aim of this work is to understand the variation in the property like resistivity, Conductivity at 157K temperature (Rohitash Kumar and Singh, 2015).

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2. Experimental Details

The weight of samples were measuring by digital electrical sensitive balance machine with (4-digits), type Adair Dutt AD-180. The mixture were prepare by Ball Mill type Retsch PM-100. The Resulting powder was pressed into pellets by using cylindrical die set with a stainless steel cylinder and hydraulic press by technosearch KBr PRESS Model-15**.** The samples were grinding and applied method of solid state reaction. The following chemical reactions type with formula $Bi_2Sr_{4-x}Ca_xFe_{3-y}Cu_yO_z$, The Tables data is already analyzed by Rohitash Kumar and H.S.Singh in (2015).

$$Bi_2O_3+2SrCo_3+2\ CaCo_3+0.5\ Fe_2O_3+2CuO = Bi_2Sr_2Ca_2FeCu_2O_2+4Co_2$$

The prepared samples were characterized by X-Ray diffraction machine type PANalytical Xpert-PRO in MNIT jaipur. A automatic computational setup has been used to investigated the lattice parameter and planes of unit cell. The XRD pattern were find by CuKα *(*1.5406 Å) radiation with fitting limit 10^0 to 90^0 (Widad *et al.,* 2012; Singh and Rohitash Kumar, 2016; Widad *et al.,* 2012).

3. Resistivity Measurements

The Study of samples was carried out from 298K to157K in IIT Roorki Uttrakhand. The Tc of the superconducting samples were measured by four-probe technique (Iida *et al.,* 2010). In the Four-Prove method, a small current is passed through a sample and the voltage drop across it.

Table 2.1.

S. No.	Compound	Bi-2212 & Bi-2223			Grinding time	Cell parameter Å	Mol Weight	Delta Displacement (mm)	System	Crystal Size
		$2\theta^0$	d(A)	(h, k, l)						
		23.23	3.825	(0 0 8)						
		29.16	3.060	(0010)		a =3.810			Tetragonal	
1	$Bi_2Sr_4CaFe_{2.8}Cu_{.2}O_z$	35.16	2.550	(0012)	5h	c=30.600	479.77	0.13	Lattice-	126.8A
		47.68	1.905	(2 0 0)					(body Centred)	
		18.45	4.803	(011)						
		23.73	3.745	(111)		a =6.008				
2	$Bi_2Sr_4CaFe_{2.6}Cu_{.4}O_z$	29.71	3.004	(200)		b =8.376	238.09	-0.067	Orthorhombic	373.2A
		30.47	2.930	(002)	5h	c =5.863				
		35.17	2.549	(211)						
		48.52	1.874	(222)						
		23.15	3.837	(008)						
		24.82	3.583	(113)						
		27.47	3.244	(115)						
		29.13	3.062	(0010)						
		31.01	3.880	(117)		a =5.4260			Orthorhombic	141.4A
3	$Bi_2Sr_4CaFe_{2.4}Cu_{.6}O_z$	35.11	2.553	(0012)	5h	b =5.4020	834.45	-0.056	(Base centred)	
		35.21	2.546	(119)		c =30.643				
		41.20	2.189	(0014)						
		50.60	1.802	(1115)						
		55.80	1.646	(135)						
		56.64	1.623	(2210)						

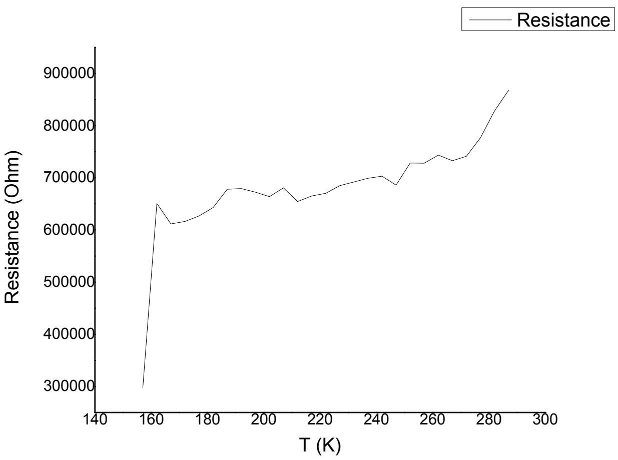

Fig. 3.1 The resistance versus temperature for $Bi_2Sr_4CaFe_{2.8}Cu_{.2}O_z$ Tc, 157K

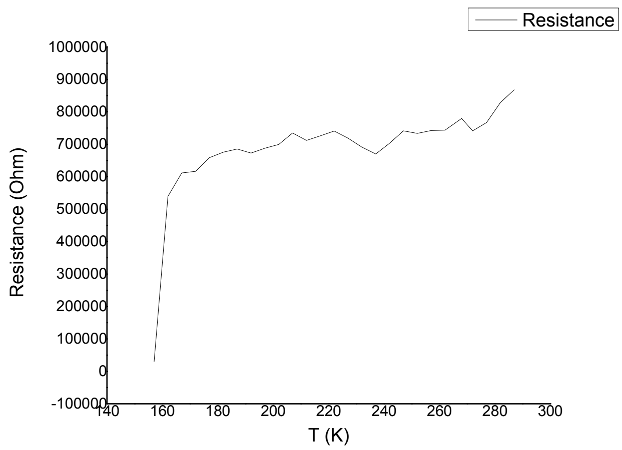

Fig. 3.2 The resistance versus temperature for $Bi_2Sr_4CaFe_{2.6}Cu_{.4}O_z$ Tc, 157K

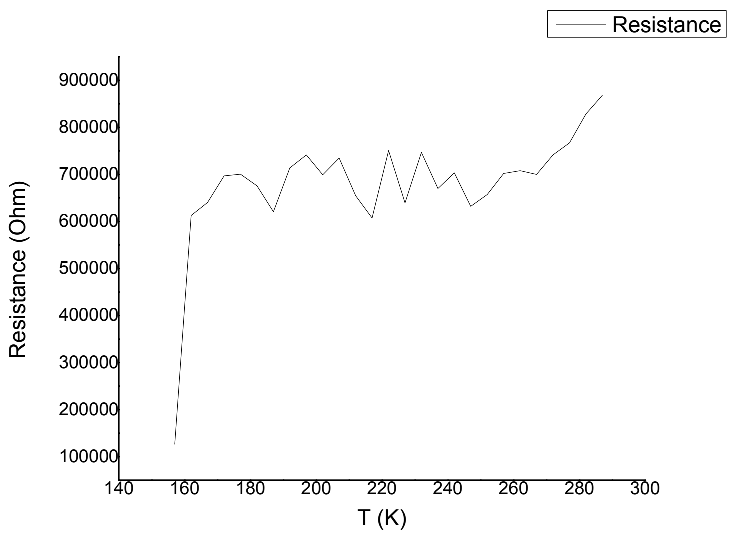

Fig. 3.3 The resistance versus temperature for $Bi_2Sr_4CaFe_{2.4}Cu_{.6}O_z$ Tc, 157K

Table 3.1.

Resistance (Ohm)	Sample Temperature (K)
297178.1	157
650889.01	162
611599.37	167
616510.56	172
626960.02	177
643073.12	182
678193.64	187
679459.52	192
672534.44	197
663939.54	202
680863.96	207
654711.01	212
665233.32	217
670326.21	222
685163.31	227
691982.55	232
699283.54	237
703245.67	242
686028.142	247
728456.87	252
728147.6	257
743554.69	262
732770.33	267
741333.42	272
777335.48	277
828527.09	282
868037.07	287

Table 3.2.

Resistance (Ohm)	Sample Temperature(K)
30194.77	157
539266.4049	162
611599.37	167
616510.56	172
658659.66	177
675696.8283	182
685324.84	187
672853.18	192
687779.67	197
699343.5	202
734711.8854	207
712022.43	212
726079.5	217
740582.85	222
718778.24	227
691450.79	232
669980.0506	237
703245.6719	242
741430.82	247
733528.05	252
742297.68	257
743554.69	262
779418.38	268
741333.4269	272
767104.7224	277
828527.0929	282
868037.5578	287

The terminals distinct from those used for passing the main part of the current through the specimen and the electrical contacts of the sample were made of fine copper wires and adhered with silver paste. The system was used for the measurement of critical resistance of the sample, with the presence of liquid nitrogen. The experimental results obtained for the different compounds are show in Table- 3.1 to 3.3 and Fig-1,2,3. It can be seen from the variation of the resistance the sample exhibit superconduc

Table 3.3.

Resistance (Ohm)	Sample Temperature (K)
126576.835	157
612762.888	162
640434.6333	167
697033.9134	172
700392.0794	177
675696.8283	182
620601.2254	187
713841.497	192
741327.2367	197
699343.5	202
734711.8854	207
654711.009	212
607369.533	217
750693.9259	222
639605.889	227
746817.3231	232
669980.0506	237
703245.6719	242
632060.4208	247
657263.9493	252
702119.0529	257
708035.126	262
700050.9003	267
741333.4269	272
767104.7224	277
828527.0929	282
868037.5578	287

5. Conclusion

The temperature at which the transition takes place in the absence of magnetic field is called critical temperature (Tc). Tc is found to be different for different samples so above Tc,a given sample is in the normal state, while below Tc it is the superconducting state for a chemical pure and structurally perfect sample, the superconducting transition is sharp while for structurally impure samples or the samples containing some impurity elements, Because the critical temperature range is broad. The resistance of the samples is varied with the temperature from 298K to 157K which is show in the fig-1-10. The comparisons of XRD results and Four-prove methods confirm that structure of Bi2Sr4Fe3O12 observed by Retoux *et al.,* (1989). These are the second type superconductors.

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