BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
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ESTABLISHED 1996

Global Conference on Superconductivity (GCS-2025): A New Scientific Horizon for Energy Crisis

INTERNATIONAL YEAR OF
Quantum Science
and Technology

Symposia on Materials for Energy Application (SMEA-2025) & Synthesis and Characterization of Carbon Materials (SSCCM-2025) Destined to Play a Significant Role in the Technology of the New Millennium

5-7 December 2025

The United Nations General Assembly adopted a resolution proclaiming 2025 as the International Year of Cooperatives. It gives us immense pleasure in sharing the Brochure of the **"Global Conference on Superconductivity (GCS-2025): A New Scientific Horizon for Energy Crisis Symposia on Materials for Energy Application (SMEA-2025) & Synthesis and Characterization of Carbon Materials (SSCCM-2025), Destined to Play a Significant Role in the Technology of the New Millennium"** jointly organized by **Department of Chemistry, School of Physical & Decision Sciences, BBAU, Lucknow and The Asian Association of Sugar Cane Technologists' (AASCT), Lucknow from December 5-7, 2025.**

For details please visit (http://www.gcs.org).

Please send your paper at professorkamansingh2025@gmail.com

International Cooperative Alliance
U.N. International Year of Cooperatives

CONFERENCE VENUE

Bharat Ratna Atal Bihari Vajpayee Auditorium
Babasaheb Bhimrao Ambedkar University
(A Central University)
Lucknow - 226 025, U. P. (INDIA)

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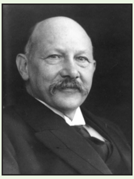
For decades, superconductivity has been the subject of intense discussion in class rooms and laboratories of scientists due to cryogenic requirements of low temperature superconductors. Today, however, superconductivity is being applied to many diverse areas such as: medicine, theoretical and ex-perimental science, the military, transportation, power production, electronics, as well as many other areas.

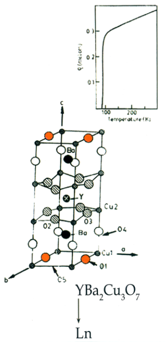
Historical Background



N.L. Heike Kammerling Onnes (1913)

Superconductivity was first discovered in 1911 by the Dutch physicist, Heike Kammerling Onnes. In the same year. He began to investitage the electrical properties of metals in extermely cold temperatures. It has been known for many years that the resistance of metals fell when cooled below room temperature, but it was not known what limiting value the resistance would approach, if the temperature were reduced to very close to 0 K. Onnes passed a current through a very pure mercury wire and measured its resistance as he steadily lowered the temperature. Much to his surprise there was no leveling off of resistance, let alone the stopping of electrons as suggested by Kelvin. At 4.2 K the resistance suddenly vanished. Current was flowing through the mercury wire and nothing was stopping it, the resistance was zero. According to Onnes, "Mercury has passed into a new state, which on account of its extraordinary electrical properties may be called the "superconductive state".

High - temperature superconductors



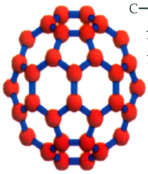
In December 1986, an oxide of copper was found to become superconducting around 35K. Till then 23K was the highest T_c. *

First liquid nitrogen superconductor (90K) in February 1987.

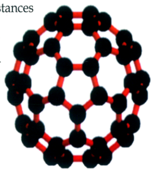
Superconductors became chemicals after 1987, and solid state chemistry got to be recognised as part of main-stream chemistry.

* Bednorz and Müller were awarded the physics Nobel prize for this discovery in 1987.

Fullerenes



C— C distances
1.40 Å
1.45 Å



C_{60} C_{70}

contain 6 - membered rings & 5 - membered rings

Discovered, 1985 (Kroto, Smalley and curl)
Prepared in the laboratory, 1990 (Kratschmer et al)
Nobel Prize to Curl, Kroto and Smalley (1996)

Milestones in Superconductivity

1911: Dutch physicist Heike Kamerlingh Onnes discovers superconductivity in mercury at temperature of 4 K.

1913: Kamerlingh Onnes is awarded the Nobel Prize in Physics.

1933: W. Meissner and R. Ochsenfeld discover the Meissner Effect.

1941: Superconductivity in niobium nitride at 16 K.

1953: Vanadium-3 silicon found to superconduct at 17.5 K.

1962: First commercial niobiumtitanium superconducting wire.

1972: John Bardeen, Leon Cooper, and John Schrieffer win the Nobel Prize in Physics for the first successful theory of how superconductivity works.

1986: Alex Müller and Georg Bednorz make a ceramic compound of lanthanum, barium, copper, and oxygen that superconducts at 35 K.

1987: Cerarnic that superconducts at 92 K, bringing superconductivity into the liquid nitrogen range.

1988: Allen Hermann of the University of Arkansas makes a superconducting ceramic containing calcium and thallium that superconducts at 120 K. Soon after, IBM and AT&T Bell Labs scientists produce a ceramic that superconducts at 125 K.

1993: Superconductor made from mercury, barium and copper, ($Hg_2Ba_2Ca_2Cu_3O_8$) with maximum transition temperature of 133 K.

2003: Nobel Prize in Physics and medical science for superconductivity and its application in MRI.

THEMES

Bridging the Gap: Advancing Superconductivity Technologies as a Key Solution for the Energy Transition

Superconducting Electronics: Present toward Future

Modelling High-Temperature Superconductors for Large-Scale Applications: Mechanical, Thermal, and Electromagnetic Behavior

Superconductivity for a Sustainable Future: The Promise of HTS

On the Properties of Elemental and High-Tc Superconductors in a Unified Framework

High-Tc Superconductivity: A Solid State Chemistry Model

High Temperature Superconductivity: Current Results and Novel Mechanisms

Nano Technology

Nano Medicine

Experimental & Theoretical Tools in Materials Study

Nanomaterials: Fabrication and Functionalization

Inorganic and Organic Advanced functional Materials

Toxicology and Green Technology

Advanced Optical and Energy Materials

Advanced Polymeric Materials and Carbon Based Materials

Advanced Materials in Environment, Agriculture and Food Technology

Fullerene and Graphene (Raw materials for their commercial production)

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RESEARCH ARTICLE

Transition Temperature versus Formula Mass of Selected High- T_C Oxide Superconductors: A Step Closure to Room Temperature Superconductivity

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Abstract

The transition temperature T_c of the superconductor signals the onset of superconductivity. We were curious to see the variation of T_c with the formula mass (F_M) of well-studied high-T_c oxide superconductors to observe whether there exists any correlation between T_c and F_M of these oxide superconductors. Interestingly, it is observed that the ratios of T_c /F_m of 8 different high-T_c superconductors which exhibit transition temperature ≥ 90 K, converge to show a ratio of 0.136 with a 14% deviation. Other superconductors and bismuth-based which have T_c less than 90 K differ significantly. Extrapolating the transition temperature to 25 °C, a formula mass F_M of high-T_c oxide superconductor turns to be 2239 with only 14% deviation in different materials which have T_c ≥ 90 K. This means if oxide superconductors of formula mass 2239 are synthesized, then that materials could exhibit room-temperature superconductivity. The experimental work on YBCO superconductors is underway and results will be communicated essentially an extension of the present work.

Keywords Formula mass · T_c / F_M ratio · Composite · Polymerized superconductors

1 Introduction

Since, the discovery of superconductivity by Dutch physicist Heike Kamerlingh Onnes [1], in 1911, it has been a topic of hot discussion in classrooms and laboratories due to the cryogenic requirements of low temperature superconductors. Today, however, superconductors are being used in varying areas such as in medical scanners, theoretical and experimental science, in the military, transportation (Maglev trains), power production, electronics, as well as many other areas. Superconductors are materials that conduct electricity without power loss and produce strong

Table 1 Data showing T_c *versus* formula mass of high-temperature superconducters

S. no.	Material	Formula Mass	Tc (K)	Slope Tc / FM	Slope = 90 K	Formula mass (298 K)
1	$YBa_2Cu_3O_7$	667.00	92	0.138	0.138	2161
2	$Bi_2Sr_2CuO_6$	752.74	20	0.027		
3	$Bi_2Sr_2CaCu_2O_8$	888.36	85	0.096		
4	$Bi_2Sr_2Ca_2Cu_3O_6$	959.98	110	0.115	0.115	2601
5	$Tl_2Ba_2CuO_6$	842.96	84	0.100		
6	$Tl_2Ba_2CaCu_2O_8$	978.58	108	0.110	0.110	2767
7	Tl2Ba2Ca2Cu3O10	1114.20	125	0.112	0.112	2670
8	$TlBa_2Ca_3Cu_4O_{11}$	1029.45	122	0.119	0.119	2242
9	$HgBa_2CuO_6$	634.79	94	0.148	0.148	1911
10	$HgBa_2CaCu_2O_6$	738.41	128	0.173	0.173	1719
11	$HgBa_2Ca_2Cu_3O_8$	874.04	134	0.153	0.153	1944

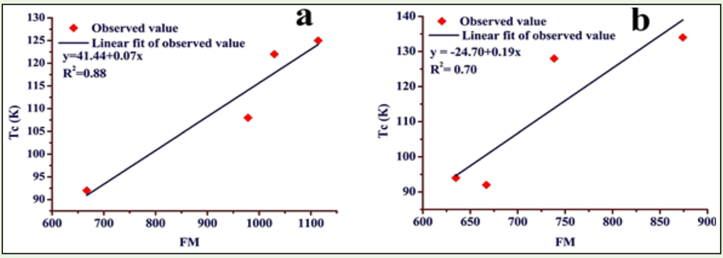

Fig. 1 (a) T_C vs FM plot of YBCO and Tl-based oxide superconductors (b) T_C vs FM plot of YBCO and Hg-based oxide superconductors

magnetic fields. With the discovery of high-temperature superconductors, which can operate at liquid nitrogen temperatures (77 K), it has emerged as an effective tool for various industrial and scientific applications. The highest temperatures [2] at which even the best of these materials become resistance-free is -70 °C. Application of shining lasers at superconductors can make them work at higher temperatures, recently suggests new findings from an international team of scientists [2]. Currently, superconductors only work at very low temperatures, requiring liquid nitrogen or helium to mention their temperature. Now, scientists [2] have found a way to make certain materials superconduct at higher temperatures.

Clark [2], a theoretical physicist university of Bathe, worked with his experimental physicist colleagues to try to understand low superconductivity might emerge when the material is exposed to laser radiation. He explained; "Super- conductors currently only work at very low temperatures, requiring expensive cryogenics-if we can design materials that superconduct at higher temperatures, or even room M. Prasad et al. Transition Temperature versus Formula Mass of Selected High-T_C Oxide Superconductors: A Step Closure to…temperature, it would eliminate the need for cooling, which would make them less expensive and more practical to use in a variety of applications.

Related research led by Waterloo physicist [3] showed proof of electronic nematicity-a situation whereby electron cloud snaps into an aligned and directional order- in a particular type of high-temperature superconductor. In this study, they "identified some unexpected alignment the electrons- a finding that is likely generic to the high-temperature superconductors and in time they turn out to be a key ingredient of the problem". The proof the scientists put forward indicates the electronic nematicity is a general feature of cuprate high-temperature superconductors-where cuprates are copper-oxide ceramics made up of two-dimensional layers of planes of copper and oxygen atoms divided largely by other atoms.

It has become apparent in the past few years that the electrons involved in superconductivity can form pat- terns, stripes, or checkerboards, and exhibit different symmetries-aligning preferentially along one direction, "Their study [3] revealed, "these patterns and symmetries have important consequences for superconductivity- they can compete, coexist or possibly even enhance superconductivity".

Soon after the discovery of ceramic high-temperature superconductivity by Bednorz and Muller [4] in 1986, there were enormous research activities in the world's many lab- oratories employing different groups of metal oxides with expectations to raise transition temperature as high as possible. Various metal oxides with different stoichiometric ratios were thoroughly investigated and repeatedly studied to assess the authenticity of the variable transition temperature reported to the specialized Journals meant for high temperature superconductors. Physicists, material scientists, chemists, engineers, theorists, mathematicians and computer experts including science administrators got engaged with two major objectives:

(i) To search for materials that could exhibit superconductivity closer to room temperature and.

(ii) To enrich our understanding of the mechanism of high T_c-oxide superconductors.

This is because the phenomenon of superconductivity in these materials was considered different and exotic from low-temperature superconductors observed in metals and alloys [5-7]. Such vigorous efforts have resulted in approximately two hundred thousand papers by a large number of researchers all over the world with new experimental and theoretical techniques [8-12]. However, the two objectives cited above are yet to be achieved. Under the prevailing situation, the attempts to research for new materials that could meet our goals particularly, T_c closer to room temperature, therefore, research efforts in oxides were seemingly diverted to look for applications of these materials available to us. Now major laboratories and researchers are deeply involved in the projects and activities of making high-T_c superconducting devices [13-17].

We viewed the variable transition temperature of high-T_c oxide semiconductors from their formula mass perspective. We selected these materials and intend to examine the formula mass of these ceramic superconductors Table [18].

Such data are shown in Table 1 [18]. Let us look at the variation of T_c on the formula mass of these materials shown in Table 1. Transition temperature increases almost linearly with F_M. The slope of T_C/F_M in the case of $YBa_2Cu_3O_7$, Tl- based (Fig. 1a) and Hg-based (Fig. 1b) oxide superconductors are in excellent agreement with an average value of 0.142 with a 4% deviation. However, taking 8 high T_C-oxide superconductors which have $T_C \geq 90$ K shown in Table 1, gives $T_C/F_M = 0.136$ with a 14% deviation. Reviewing T_C versus formula mass data closely, it is noticed that materials #1,8,9,10 and 11 represent an excellent fit in a straight line if plotted as T_C versus formula mass. Other materials, # 4,6 and 7 show higher formula mass for room temperature though the slope remains nearly closer. This consistency among the different classes of high-temperature superconductors seems to be unnoticed by researchers. Accordingly, we extrapolated the formula mass of materials that could exhibit T_C closer to room temperature. Looking at the last column of Table 1, we find that the hypothetical average formula Mass of 8 oxide high-T_C materials given above turns out to be 2239 with a 14% deviation. This empirical analysis of T_C *versus* formula mass seemingly suggests that if YBCO, Tl-based and Hg-based oxides, etc. of much higher masses are synthesized virtually in the polymerized form/composites, we are likely to get transition temperature higher and closer to room temperature.

1.1 Motivating Factors

Superconductivity was initially discovered in mercury at liquid helium temperature by Onnes [1] in 1911. All metals and alloys possess a very high electron density. It is the high electron density and mobility of charge carriers that make a distinction between superconductors, metals, and semiconductors. In other words, it is the absolute value of electrical conductivity that helps us classify different kinds of conductors. Reports on some high-temperature superconductors suggest that thinner [16, 17] samples exhibit semiconductor-like behavior whereas thicker ones showed metallic-type characteristics prior to superconducting transition. More recently [19] in YBCO demonstrated that transition temperature T_C has very much to do with the 3D-charge carrier concentration and they reported the value $1.6 \times 10^{21} cm^{-3}$. Such information on 3D charge density in a high-temperature superconductor is viewed from a perspective of raising the carrier density comparable to metallic conductors in the oxides by synthesizing composite-polymerized sort of materials that could ensure the increased concentration of charge carriers at par with metals and alloys that could exhibit T_C closer to ambient temperature and pressure.

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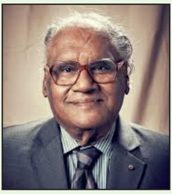
- V.K. Tiwari, Dept. of Chemistry, BHU, Varanasi

Plenary Speakers (More Speakers to be added)


Prof. Mahendra Prasad
Source of Inspiration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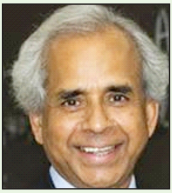
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Sugar and Bio-Products: International Research Needs for the Future

Many more to be included

KEY DATES

- Deadline for Abstract Submission: **15 October, 2025**
- Notification of Acceptance of Abstract: **15 November, 2025**
- Last Date for Submission of Full-length Paper and Registration: **15 November, 2025**
- **Conference Date: December 05-07, 2025**
- **Inauguration: December 05, 2025**

REGISTRATION PROCESS

The registration fee (Which includes the registration and free lunch & dinner, refreshment, tea etc. throughout the conference period) will be charged:

	Early Bird (Ocbober 15, 2025)	**Till Dec. 05, 2025**	**Spot Registration**
Overseas Participant	US$ 215	US$ 265	US$ 316
Overseas Students	US$ 115	US$ 165	US$ 215
Faculty	INR 3000	INR 3500	INR 4000
Research Scholar (Paid)	INR 2000	INR 2500	INR 3000
Research Scholar (Non-Paid)	INR 1800	INR 2000	INR 2500
Student (UG & PG)	INR 1000	INR 1500	INR 2000
Accompanying Person	INR 2500	INR 3000	INR 3500
Participant from Industry	INR 5000	INR 6000	INR 7000

All participants have to pay the registration fees before submitting an application either

(I) via DD in favor of **GCS-2025** OR

(ii) Online transfer to the account of the following

Account Holder's Name: **GCS_2025**

Bank Name: Canara Bank Branch: BBAU, Lucknow

Account Number: **https://erp.eshiksa.net/DirectFeesv3/BBAU**

Brochure and registration form can also be downloaded from **http://www.GCS_2025.org**

The template for abstract and full-length paper is available on the conference website: **www.GCS_2025.org**

For any queries, please feel free to write us at **professorkamansingh2025@gmail.com/drkamansingh@yahoo.com**

For all updates please visit our website: **http://www.gcs.org**

Young Scientist Awards

Cash award and Certificates will be given to young scientists (below the age of 35) on competition basis based on oral and poster presentations during the conference.

Accommodation

Accommodation may be arranged for outstation participants in the University Guest House on payment basis as per the tariff and guidelines of the same, depending on the availability. Accommodation in 3 and 4-Star Hotels can also be arranged on payment basis and availability.

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Advisor to Chairman (GSC-2025) Prof. Dr. V.B. Sharan, Humboldt Fellow, Germany

ABOUT THE CITY - LUCKNOW

Lucknow or Lakhnau is the capital city of Uttar Pradesh (India), resides on the bank of river Gomati. Located in what was originally known as the Awadh (Oudh) region, Lucknow has always been a multicultural city, and flourished as a cultural and artistic capital of North India in the 18th and 19^{th} centuries. Courtly manners, Nawabi culture, beautiful gardens, poetry, music, and fine cuisine patronized by the Persian-loving Shia Nawabs of the city are well known amongst Indians and students of South Asian culture and history. Lucknow is popularly known as The City of Nawabs. The Hindu holy places Ayodhya is about 135 km away from Lucknow The temperature range will be around 32º-15ºC. Details about Lucknow are also available at www.up-tourism.com.



How to reach

Lucknow is well connected to all the major cities in the country by air, rail and roadways. Superfast/Express trains are available throughout the day and night to/from all major cities. Charbagh Railway Station is about 9.5 km from the University. Chaudhary Charan Singh Domestic/ International Airport is about 4.5 km from the University. Indian Airlines, Jet Airways, Jet Lite, GoAir, Indigo etc., operate flights from Lucknow to all over India. The normal frequency from Delhi to Lucknow and return is around 4-6 flights/hour each way.

Sightseeing for Accompanying Persons


Charbagh Rialway Station


Bada Imambara


Dilkusha Garden


Rumi Gate


Residency


Ambedkar Park


La Martiniere College


University of Lucknow


Chota Imambara


Janeshwar Mishra Park


Chattar Manzil


King Georges' Medical University



Sankat Mochan Hanuman Temple