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Study of room-temperature superconductors

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Radical developments have recently taken place in the field of superconductors. More specifically, high temperature superconductors have been a focal point and therefore many modifications are being made in the types and varieties of products which employ such devices. In order to better appreciate and understand this field and its implications, it is necessary to attain knowledge of the history and basic principles of superconductivity. With this in mind, the exploration of current applications is ensued in light of recent discoveries. With these topics in focus, it is the goal of this paper to obtain a better understanding and appreciation for research in the field of superconductors. The conclusions drawn are that while much advancement has been made in the field of high temperature superconductors, there is much more room for improvement. The effect seen by such improvements are then widespread throughout medical technologies as well as countless other applications. A room-temperature superconductor is a hypothetical material that would be capable of exhibiting superconductivity at operating temperatures above 0 °C (273.15 K). While this is not strictly room temperature, which would be approximately 20-25 °C, it is the temperature at which ice forms and can be reached and easily maintained in an everyday environment. The highest temperature known superconducting material is highly pressurized hydrogen sulfide, the transition temperature of which is 203 K (−70 °C), the highest accepted superconducting critical temperature as of 2015. By substituting a small part of sulfur with phosphorus and using even higher pressures, it has been predicted that it may be possible to raise the critical temperature to above 0 °C and achieve room-temperature superconductivity. Previously the record was held by the cuprates, which have demonstrated superconductivity at atmospheric pressure at temperatures as high as 138 K (−135 °C), and 164 K (−109 °C) under high pressure, although some researchers doubt whether room-temperature superconductivity is actually achievable. Superconductivity has repeatedly been discovered at temperatures that were previously unexpected or held to be impossible. Claims of near-room temperature transient effects date from the early 1950s and some suggest that in fact the breakthrough might have been made more than once but could not be made stable enough and/or reproducible as the relationship between isotope number and Tc was not known at the time. Finding a room temperature superconductor would have enormous technological importance and, for example, help to solve the world's energy problems, provide for faster computers, allow for novel memory-storage devices and enable ultra-sensitive sensors, among many other possibilities.

Biography

Sumit Kumar Gupta is the Dean, Faculty of Science at Parishkar College of Global of Excellence Jaipur in the Department of Physics. With over 15 years of teaching, research, and administrative experience, he has held various administrative positions as the Head of Department in various degree colleges and engineering colleges and has a vast experience of teaching in IIT-JEE Institute. He had been associated with Maharishi Arvind Institute of Engineering and Technology, Jaipur for last 8 year as Associate Professor. Prior to that, he was associated with Agarwal PG College, Subodh PG College, Global Institute of Technology, Joythi Vidhyapeeth University Jaipur as faculty positions for 7 years. In his 15 years teaching, administrative and research duration, he has published 24 research papers in highly reputed UGC approved international journals.

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