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SUPERCONDUCTIVITY

Abstract. The aim of this article is to provide a general information about superconductors. Superconductivity is the weird phenomenon of zero electrical resistance that occurs when some materials are cooled below a critical temperature. To get cold enough liquid helium or nitrogen (often as low as -250 °C or -480 F) are used. This article primarily focuses on the history, the invention and the properties and the areas of usage of superconductors. The phenomena of superconductivity was first observed by Heike Kamerlingh Onnes in 1908 in Netherlands. Experimental physicists are now trying to find superconductors at room temperature. This article also intends to arouse curiosity among physics students.

Keywords: Superconductors, critical temperature, zero electrical resistance.

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Аңдатпа. Осы мақаланың мақсаты суперөткізгіштер туралы жалпы ақпарат беру. Өткізгіштік дегеніміз - нөлдік электр кедергісінің таңқаларлық құбылысы, кейбір материалдар сыни температурадан төмен салқындаған кезде пайда болады. Салқын болу үшін сұйық гелий немесе азот қолданылады (көбінесе -250 ° С немесе -480 F). Бұл мақалада ең алдымен өткір өткізгіштердің тарихы, өнертабысы және қасиеттері мен қолдану салалары қарастырылған. Өткізгіштік құбылыстарын алғаш рет Хейк Камерлинг Оннес 1908 жылы Нидерландыда байқады. Эксперименттік физиктер қазір бөлме температурасында суперөткізгіштерді табуға тырысуда. Бұл мақала сонымен бірге физика пәні студенттерінің қызығушылығын тудырмақ.

Түйін сөздер: өткізгіштер, сыни температура, нөлдік электр кедергісі.

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Аннотация. Целью данной статьи является предоставление общей информации о сверхпроводниках. Сверхпроводимость - это странное явление нулевого электрического сопротивления, которое возникает, когда некоторые материалы охлаждаются ниже критической температуры. Чтобы получить достаточно холодный жидкий гелий или азот (часто до -250 ° С или -480 F). Эта статья в основном фокусируется на истории, изобретении,

свойствах и областях использования сверхпроводников. Явление сверхпроводимости впервые наблюдал Хайке Камерлинг Оннес в 1908 году в Нидерландах. Физики-экспериментаторы сейчас пытаются найти сверхпроводники при комнатной температуре. Эта статья также намеревается вызвать любопытство среди студентов-физиков.

Ключевые слова: сверхпроводники, критическая температура, нулевое электрическое сопротивление.

Introduction

You plug the cable into the prize and run the device by passing the electrical current through the circuits. Sometimes you even work so hard, when it comes to your bill, it's like the world is crumbling.

In this article, we will examine the superconductors that shape the supreme electricity that shapes our lives. We will examine its history, where it is not used, its analysis and its physics. 103 years have an annual.

Superconductivity is the fact that the electrical resistance of some materials is zero below a certain temperature and they push the magnetic flux out. The history of superconductivity began when Dutch physicist Heike Kamerlingh Onnes discovered mercury superconductivity in 1911. Since then many other superconducting materials have been discovered and the theory of superconductivity has been developed. These issues remain active in the field of condensed matter physics.

Discovery of ultra-cold phenomenon (until 1908)

James Dewar started. Zygmunt Florenty Wroblewski conducted investigations of electrical properties at low temperatures, but his investigation was terminated due to the death of accident results. In 1864, Karol Olszewski and Wroblewski predicted the phenomenon of electricity as resistance levels dropped at ultra-cold temperatures. According to this case Olszewski and Wroblewski evidence was revealed in 1880.

Dewar and John Ambrose Fleming, pure metals can become excellent electromagnetic conductors at absolute zero (later, Dewar changed his mind, eliminating resistance, believing that a piece of conductivity would exist in his time). Walther Hermann Nernst developed the third law of thermodynamics and states that absolute zero is inaccessible. Carl von Linde and William Hampson are both commercial researchers. Linde’s patent has been the turning point in a 20-year systematic investigation of proven cases in the regenerative reverse

linkage region. Hampson's designs were also a regenerative method. History as a liquefaction method in Hampson-Linde [1].

Onnes bought a Linde machine for his research. On 21 March 1900, a US patent was issued to Nikola Tesla for the method of increasing the intensity of electrical emissions by lowering the temperature caused by low resistance, a phenomenon previously observed by Olszewski and Wroblewski. This patent describes the increased intensity and duration of electrical oscillations of a low temperature resonance circuit. Tesla is believed to intend to use Linde's machine to obtain refrigerant.

On July 10, 1908, Heike Kamerlingh Onnes was the first to produce liquefied helium at the University of Leiden, the Netherlands with a boiling point of 4.2 kelvin at atmospheric pressure.

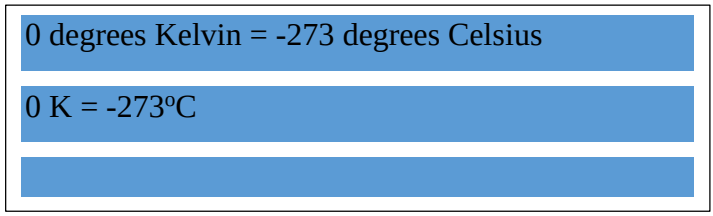

Fig. 1. Kelvin and Celsius difference

Heike Kamerlingh Onnes and Jacob Clay re-examined Dewar's earlier experiments on lowering resistance at low temperatures. Onnes began his study with platinum and gold, then replaced them with mercury. Onnes' research on the resistance of solid mercury at cryogenic temperatures was achieved by the use of liquid helium as a coolant. On April 8, 1911, at 16:00, Onnes dropped the note “Kwik nagenoeg nul “which could be translated as mercury resistance is almost zero. Onnes observed that the resistance suddenly disappeared at a temperature of 4.19 K. Onnes discovered his research in 1911 in an article entitled “About the sudden speed at which mercury resistance disappears”. In this article Onnes said that “resistivity amount is thousands of times lower in quantity than the best conductor at the usual temperature. Onnes then reversed the process and found that resistance to 4.2 K’da returned to matter. The following year, Onnes published more articles on this phenomenon. Initially, Onnes called this phenomenon “supra-conductivity” (1913), and only later, he

adopted the term “superconductivity”. Onnes received the Nobel Prize in Physics in 1913 for his research.

In 1912, Onnes conducted an experiment on the usability of superconductivity. Onnes gave an electric current to a superconducting ring and removed the battery that produced it. When Onnes measured the electric current, he found that his intensity did not disappear over time. The current was continuous due to the superconducting state of the conductive medium. In later years, superconductivity was also found in many other substances. In 1913, the lead was found to be superconducting at 7 K, and in 1941, niobium nitride was found to be superconducting at 16 K.

Features

Superconducting materials have very important basic features that make it technologically prominent. First of all, they show zero resistance to electrically correct current (d.c.) and have a very high current carrying capacity compared to normal conductors.

These properties have an important place in the transport, storage, production of strong magnets, generators and the production of sensitive electrical devices.

Extremely low resistance at high frequencies, very low signal distribution and the ability to carry signals at speeds almost close to the speed of light are important for communication, military purposes (defense industry) and microwave technologies. The fact that they transmit electrical current without resistance / loss and show very low resistance even at high frequencies eliminates the problem of heating on circuit elements or wider circuits / devices.

For normal metals, T (K) = 0 $\rho = \rho 0$, while in superconductors, T superconducting materials have very important properties such as electrical properties in terms of magnetic properties. For example, their high sensitivity to magnetic field and their ability to give 1000 times more accurate results compared to conventional magnetic field detectors and similar measuring systems are extremely important applications for today's technology. Another important feature is that they easily exclude even high magnetic fields applied from outside.

Used areas

High energy physics

Since high magnetic flux density can be achieved by superconductors, magnetic resonance imaging (MRI) devices, commonly known as absorption,

have been developed and a significant distance has been achieved in the field of medical diagnostics.

Superconducting cables

1000 KW and 10 GVA, such as the production of high-capacity power transmission cables, which have never been imaginable, have been realized. Since these cables are still very fragile, scientific research continues.

Railway transportation

MEGLAV trains moving through the strong magnetic field obtained by superconductors have been developed.

Particulate flashers

In the particle colliders used in particle physics experiments, strong magnets are required to keep subatomic particles moving at speeds close to the speed of light connected to the center, but can be made only with superconductors. Advanced level experiments can be performed.

Electronic circuits

In almost all electronic circuits and especially integrated circuits, the problems caused by the resistances of the conductors used in the interconnections are an important cost factor.

From partıcle accelerator to an nanorobot

Here, an example of the contribution of superconductors to the development of experimental facilities in scientific research, which has an important place among the various application areas, should be given. Table 1 gives the temperature values required for some materials to be superconducting.

Table 1. Temperature values for superconducting

Material	T_c
Gallium	1.1K
Aluminum	1.2 K
Indium	3.4 K
Tin	3.7 K
Mercury	4.2 K
Lead	7.2 K

Niobium	9.3 K
La-Ba-Cu-oxide	17.9 K
Y-Ba-Cu-oxide	92 K
Tl-Ba-Cu-oxide	125 K

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