

“ANALYSIS OF ELECTRICAL PROPERTIES OF SUPERCONDUCTOR MATERIALS IN THE POWER SYSTEM”

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ABSTRACT: In the Power Generation systems and an electric power transmission lines and energy saving Project in used as the Superconductive Technology. By using the superconductor materials in the effectively and verity of the fields electric power transmission lines with the zero resistance, magnetic fields and Temperature of the superconductor materials is very less in power transmission lines. In the energy saving rate increased the Voltage drop is specifically analysis of energy generation system in transmission lines. It is the possible to increase the efficiency, and the reducing the power losses. This is research and project working is mean motive Progress in an important research area of the power generation and power transmission system. Super conducting materials are mean advantages of the lower electrical losses for high capacity Electric power transmission efficiency of the technology in used standard conductors' materials. Minimization of an Environmental impact and sustainable developments in transmission lines of electric power and increased the public acceptance due to low impact subsequent reduction of the time. The renewable energy sources are those systems in the conductor materials with the high-capacity transmission of power generation systems through power transmission lines efficiency are increased. Superconductor materials Application of the very costly and critical spaces important equipments main power transmission system is composed aluminium cable in overhead line and underground cable is used in required much higher capacity in power transmission lines to electricity and population convergence of power transmission system in metropolitans area an environmental factor are save.

Key Words: Superconductive materials, Temperature Superconductive Materials, Decreasing the power loss, Cable of Super-Conductive material, Renewable energy sources

1. INTRODUCTION:

The transmission of lines in the used Superconducting Materials cables and wires are manufacturing and Applications electrical energy industries plays a vital role in efficient and stable an energy delivery of power generation in the transmission network. The electrical energy is very simply transmission of one place to another place renewable energy sources with the high-capacity of power generation systems through power transmission lines efficiency are increased. One of the most important reasons for not benefiting from electric power generation is the delay in establishing power transmission lines. The Superconductors materials are used in the very high power transmission of lines required and increase the efficiency of the power accordingly, transportation lines must be planned and implemented simultaneously with the generation sector, which ensures the rational use of the substantial required capital. The aim is to provide the efficiency increase of the transportation lines with minimal capital and time is decrease to gain the greatest possible economic efficiency. Improving the process of designing and planning an electrical power transmission lines is made of conductor materials applications in manufacturing of wire complex issue due to diverse factors affecting the established costs.

The primary goal finding the higher efficiency of the conductors materials of this study is to analysis of the protections higher density of the conductor materials is required in transmission of lines and prepare a cost model of electrical Iraqi projects, including the local required factors related to the implementation costs based on the intensive review of the design areas of power transmission lines and the challenges of erecting and operating these lines.

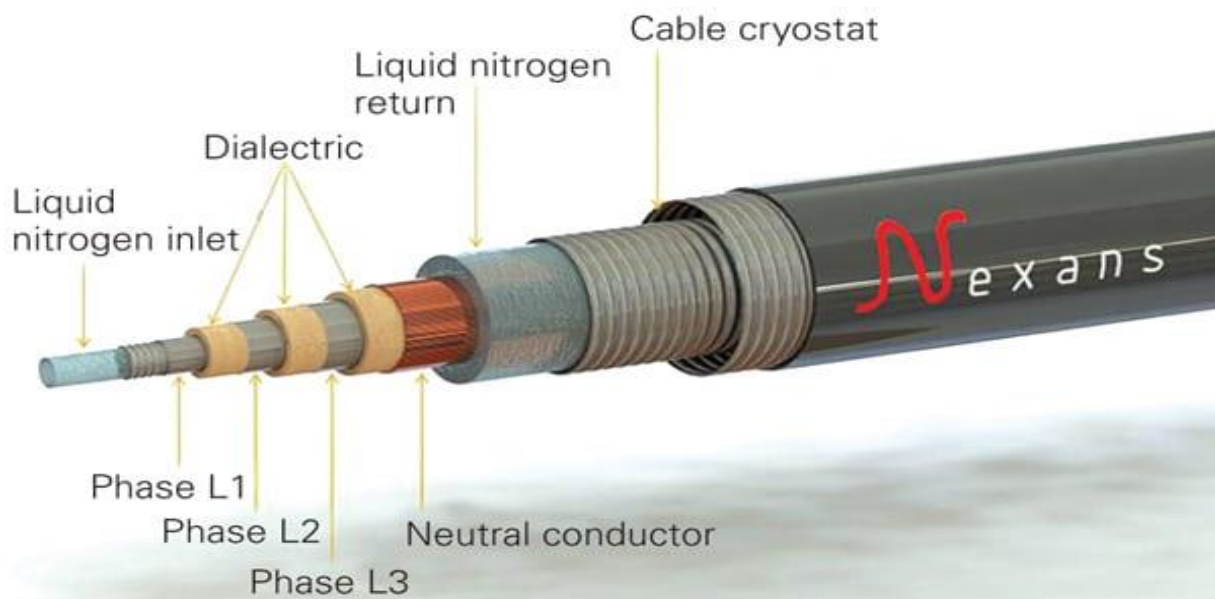


Figure.1: Superconductor material cable

The possible steps and computation model are established the testing of wires in the electric city in transmitted to the current in the caring conductors to overcome the calculation challenges, where procedures are suitable to the terrain and the local requirements for economic factors in the wire technology copper and silver materials wires in very high density form present the free electrons and current is flow is very high speeds transportation lines.

2. Superconductor materials Specifications

Superconductor material are those materials are critical temperature of the (T_c) is negative (-Ve) with the Resistance is Zero of the Superconductor materials. Temperature When their transition temperatures, of the superconductor materials are used they have zero electrical resistance. Its main application is in superconducting magnets, which are used in scientific and medical equipment where high magnetic fields are necessary.

The transmission-line construction is an arduous and complex task conductor materials wires that requires sufficient diameter of wires is requirements efficiency of considerable effort in the development of a polls distance to implement power transmission lines, which include many individual towers and polls sites at a time. The methodology binding of wires in the polls of constructing the line differs from other construction methodologies, but the changes from site to site according to the Indian Standard Organization terrain and conditions surrounding it should also be considered. Effective planning and management of electrical in research and conductors of materials are critical in developing and achieving the required quality and in maximizing the economic benefits and with environmental eco-friendly requirements, which reduces environmental damage.

3. Construction of Superconductor materials cable and wires

Superconductor materials are used in manufacturing of wires and cables Electricity transmission of lines resistance is zero and application in electronics and electrical industries and computer applications the used power saving of material efficiency is increase of the power transmission of lines. Superconductor material like Tungsten, Thorium, Mercury, Cadmium, Aluminium, Vanadium and Lead Galvanized Steel all the conductor materials used in electric energy transmission lines in construction in current caring conductor of wires.

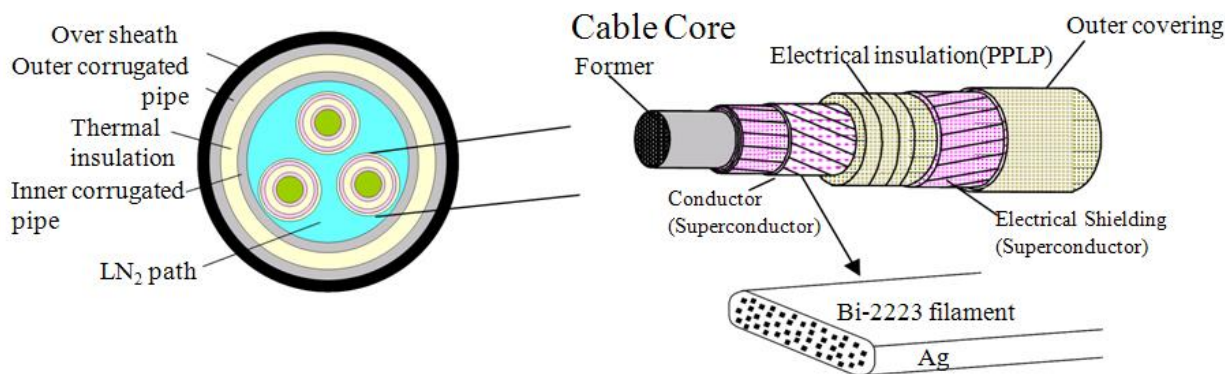


Figure.2: Transmission Lines of Super-conductor material

The superconductor materials are used in electrical and electronics media lines are often heavily loaded because of increased power consumption rate, and the Transmission lines are conductors, which are generally made of copper or conductors materials expand when heated. That the thermal expansion increases the slack between two tower transmission lines structures, causing them to sag.

Table.1: Physical Properties of the conductor materials

Superconductor Materials	Density g/cm ³	Melting Point °C	Thermal Con..... W/M.K	Electrical Con..... 1×10 ⁷ /(Ω.m)	The rmal Exp... 1/1 × 10 ⁶ °C
Copper	9.960	1085	376	59.7	18.75
Cadmium Copper	9.890	1076	370	91.00	22 To 105
Aluminium	2.720	665.3	235.0	4.770	24.50
Silver	10.5	965	433	62.35	55.00
Superconductor Gold	9.92	1067	327	0.022	16.00

The Physical Properties are presented by the Table No. 1 of the transmission lines conductors materials like i.e. Properties: Copper melting point of 1087.4 +/- 0.3°C, boiling point of Copper material 2568°C, specific gravity of Copper is 9.96 (20°C), with the valence band of energy level of copper of 1 or 2. Copper is reddish and takes a bright metallic. Other properties of the copper is It is malleable, ductile, and a good conductor of electricity and heat.

Table: 2. Electrical Properties of the conductors' materials

Materials	Resistivity (Ω .m)	Electrical Conductivity
Copper	1.7 ×10 ⁻⁵	29.2 ×10 ⁵ /Ω.cm
Cadmium Copper	1.91 ×10 ⁻⁵	26 ×10 ⁵ /Ω.cm
Aluminium	2.8 ×10 ⁻⁵	35 × 10 ⁵ /Ω.cm
Silver	1.6×10 ⁻⁵	62.3×10 ⁵ /Ω.cm
Superconductor Gold	2.3×10 ⁻⁵	44.3 × 10 ⁵ /Ω.cm

The Electrically Conductor material like that Aluminium is preferred to over the copper as an aluminium conductor is lighter in weight and Wight material and cheaper in cost than copper conductor material of the same resistance. The conductors are not straight wires but strands of wire twisted together to form a single conductor to give it higher tensile strength.

Cadmium Copper alloy of copper 98.0% and 1.0% cadmium a unique combination of high tensile strength and high electrical conductivity for an industry where these properties are generally considered incompatible.

Table: 3. Mechanical Properties of the conductors' materials

Mechanical Properties of the conductor materials are Electricity Transmission lines in Application of higher power

Superconductor Materials	Tensile Strength Yield (N/mm ²)	Tensile Strength Ultimate(N/mm ²)	Elongation Of Break (A%min)	Vickers Scale HV
Copper	200 - 310	455.00	57.00 %	220.0
Cadmium Copper	34.0MPa	210.0Mpa	62.00 %	200.0
Aluminium	100- 200	400.0	12- 25 %	176
Silver	46MPa	112MPa	80.00 %	255MPa
Super-conductor Gold	80-950MPa	185 - 1910	45-60 %	225

transmission lines minimum mechanical strength requirement for magnet wire may evolve in order to improve formability and prevent excessive stretching of wire during high speed coiling operations.

4. Experimental Testing and Results and Discussions

Measurements of Current, Voltage and efficiency of the electric power transmission lines conductor materials by the help of electrically equipments. Due to the need to increase the transmission of high-speed voice and data signals, the surface quality of copper wire is expected to continue to improve. Demands is increase of the copper wires in the Electricity generation of power system and Electronic Industry in making the Electronic Equipments, wires, cables, and some of domestic articles for better drivability and movement towards “zero” defects in copper conductors are expected to continue. Copper current-carrying is equal to 1.2 times the total volume of the copper.

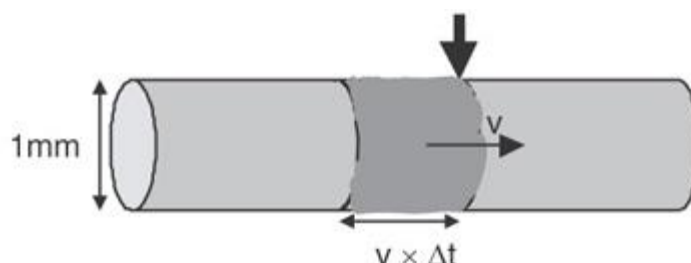
5. The Speed of Electrons in Conductor materials

The Electrons Speed in Conductor materials of an electric power transmission lines depends on the Speed of the electrons in the conductor wire.

We can Estimation the speed of the electrons in the transmission lines wires based on the many electrons passes by the section of the wire per second, the density of the electrons in the electric power transmission lines wire, and the cross-sectional area of the wire. By Using the Formula

$$I = \frac{\Delta Q}{\Delta T} = \frac{Q \times N \times A \times V \times \Delta T}{\Delta T} = q \times n \times A \times V \dots\dots\dots (A)$$

$$V = \frac{I}{q \times n \times A} \dots\dots\dots (B)$$



Supper conductor material the electrons moving down a wire the number passing the arrow per second is the current and is related to the velocity of the Electrons density of the conductor wires from which we can calculate the velocity of the electrons as: where:

I = current passing one point, in Amps ΔQ = charge flowing in a time interval, in Coulombs

ΔT = time interval, q = charge of one electron = 1.6 × 10⁻¹⁹ Coulombs,

n = density of free electrons, in $1/m^3$, A = cross-sectional area of the wire, in m^2 ,

V = speed of the electrons in the wire, in m/sec . Each copper atom contributes roughly two free electrons that can move through the wire. Atoms of copper are about 1 nm apart. This makes the density of free electrons, n , about $n \sim 10^{27}/m^3$.

6. Experimental Testing and Results and Discussions

Electrical conductivity is conductor materials a measure of how well a material transport an electric charge and electricity. This is an essential property in electrical wiring systems. Copper has the highest electrical conductivity rating of all non-precious metals: the electrical resistivity of copper = 16.78 ($\Omega \cdot m$) at 20 °C.

Table 5: Temperature of the superconductor material of the cable electricity transmission of power

Elements	Symbols	Tc (K)	Tc (°C)	Tc (°F)
Tungsten	W	0.02	-273	-465
Thorium	Th	1.35	-265	-467
Mercury	Hg	4.25	-280	-462
Cadmium	Cd	0.80	-275	-459
Aluminium	Al	1.70	-271	-467
Vanadium	V	5.5	-269	-460
Lead	Pb	7.3	-267	-457

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6. CONCLUSIONS:

Appliance conductors for domestic applications and instruments are manufactured from bunch-stranded soft wires, which may be tinned for soldering or phase identification. Applications of conductor material and increase the Resistance welding Electrodes, circuit Breaker Switches, stud bases of power transmitters, Electrical Conductor Material, Rod Extensions, Pencil-type, Light Soldering guns, Connectors, Solder less wrapped, Welding Wheels, Trolley Wires. Retaining Rings, Roll pins, Lock Washers, Fasteners, shaft, Pump Parts, Non Sparking Safety Tools, Flexible Metal Hose, Welding Equipments, Diaphragms, Bourdon Tubing.

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