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Effect of Cryogenic Treatment on Density, Resistivity and Conductivity of Manganese Used in Lithium-Ion Batteries

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Abstract: ***Refrigeration is one of the core branch in the field of thermal engineering. In other words, we can say that the refrigeration is the sister branch of the thermal engineering or thermal science. The main purpose of refrigeration is to maintain the low temperature than the atmospheric temperature or simply room temperature. In a few decades, the new trends in the field of the refrigeration and air condition has been changed drastically. The need for the development of new refrigeration processes is to achieve possible minimum temperature by the liquefaction techniques such as linde claude system. The new field known as cryogenics is developed in recent few years whose main aim is to achieve the lowest possible temperature in order of -100 to -150^0 C. the cryogenics has a wide veriety of the applications ranging from space research to the medical science which can be supposed as a science fiction in the real life. Our research work is based on the analysis of the cryogenic treatment to the lithium ion battery to improve the performance of the battery for the long period.***
Keywords: Cryogenics, lithium ion batteries, manganese, density, conductivity

I. INTRODUCTION

The process of achieving the temperature below the atmospheric temperature or room temperature is called as refrigeration.the refrigeration is considered as the one of the core branch in the field of thermal engineering or thermal science. In the old era, the refrigeration was achieved with the help of natural snow which was brought from the cold areas. The food material which is being preserved was placed in the flowing water of the river so that the heat from the food items whose temperature is being kept below the room temperature. After the invention of refrigerant, the various cycles or the pathways for the circulation of the refrigerant were invented which improved the performance of cooling process. The same concept is incorporated in the advanced cryogenics in which advanced systems like double cascade system is used nowadays.

The main aim of cryogenic is to obtain a supercooled temperature which is enough to liquefy the gases at the decreased temperature. The cryogenic application includes the application in space for storage of the liquid oxygen and hydrogen which can be used as a propellant fuel for the rocket launcher of a satellite. As the cryogenics is associated with the achievement of low temperature, the properties of material may get changed to considerable extent which can form a basis for the further investigation.

II. LITERATURE REVIEW

1) The scholar article entitled as " Deep Cryogenic Treatment" published by the author C Delprete et al, in this research paper, they have taken a brief review on the recent developments in the cryogenics field.they concluded their work by a concluding remarks, where remarkable changes were noticed in the properties of steel.(Mechanical)[1]

2) The research article entiled as "Effect of cryogenic treatment on mechanical properties of 4340 steel" published by author S zirafar et al in which the mainly focussed on the mechanical testing of parameters such as impact strength and hardness and fatigue. The crux of the research work was found that the cryogenic treatment applied to the material changes the mechanical properties up to noticeable extent. They gave cryogenic treatment to the 4340 steel. [2]

3) One of the research article entitled as "Cryogenic Treatment And It's Effect On Tool Steel" Published By T. Yugandhar and team. In their research paper, tools required for various applications in the field of presswork is studied very finely. The main work of their research is the comparison of the tool properties of both the cryogenic treated tools to the non cryogenic treated tools. The outcome of their research work is that they found that the life of some tools increased to the noticeable extent such as the tools made up of oil hardened non shrinkage steel. The same thing is happened with the D2 material.[3]

4) The research article entitled as "Study on the Characteristics of a High Capacity Nickel Manganese Cobalt Oxide (NMC) Lithium-Ion Battery—An Experimental Investigation" published by ruifen zhang and team. In their research work,they found out the details about the working parameters of the manganese in the high capacity battery.[4]

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III. EXPERIMENTAL SETUP

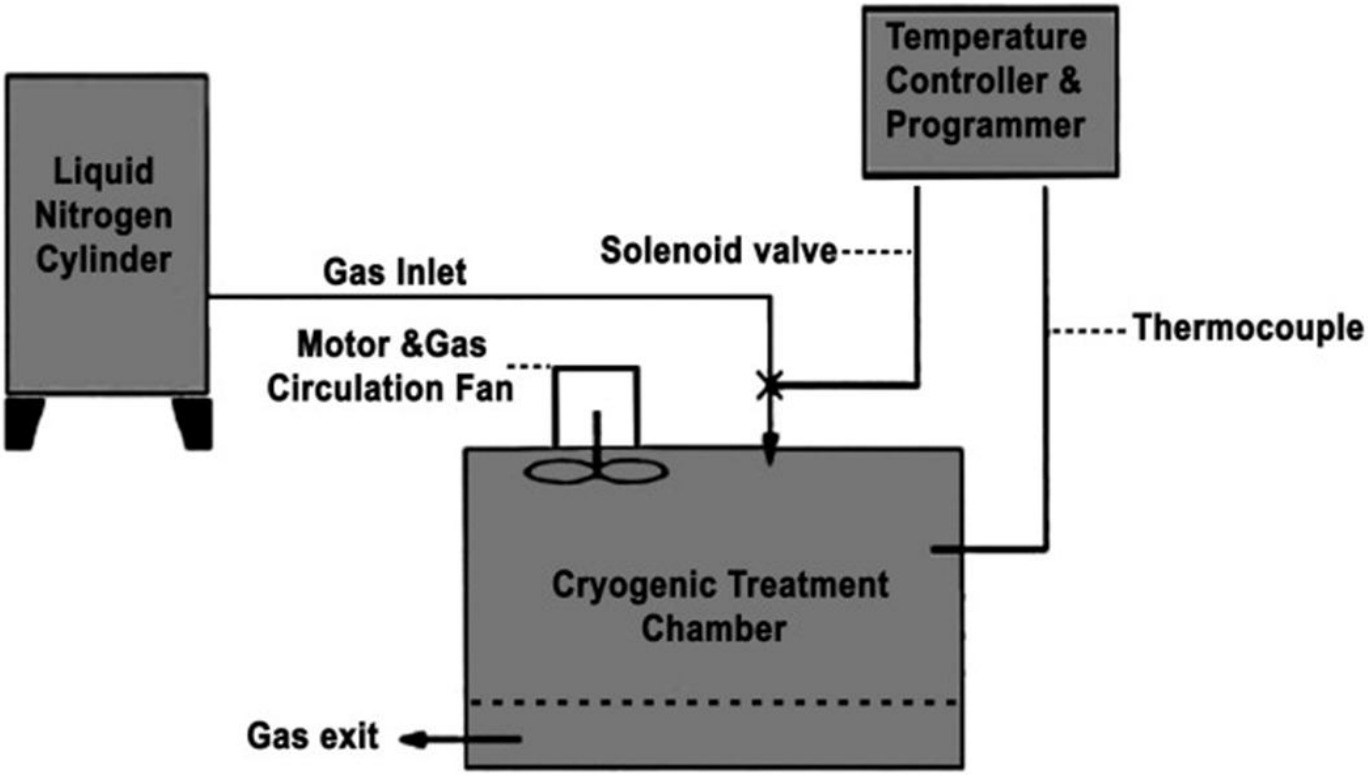


Fig.1. Cryogenic set up block diagram

The electrical resistance of any material is dependant on 3 main factors as length, cross sectional area and a constant called as resistivity which is given mathematically as

Resistance = (length of conductor x resistivity)/ cross section area

The snapshots of the elements of the setup are shown herewith.



Figure 2 Nitrogen cylinder



Figure 3. Cryogenic chamber

The readings obtained by taking successive trials are mentioned as follows.

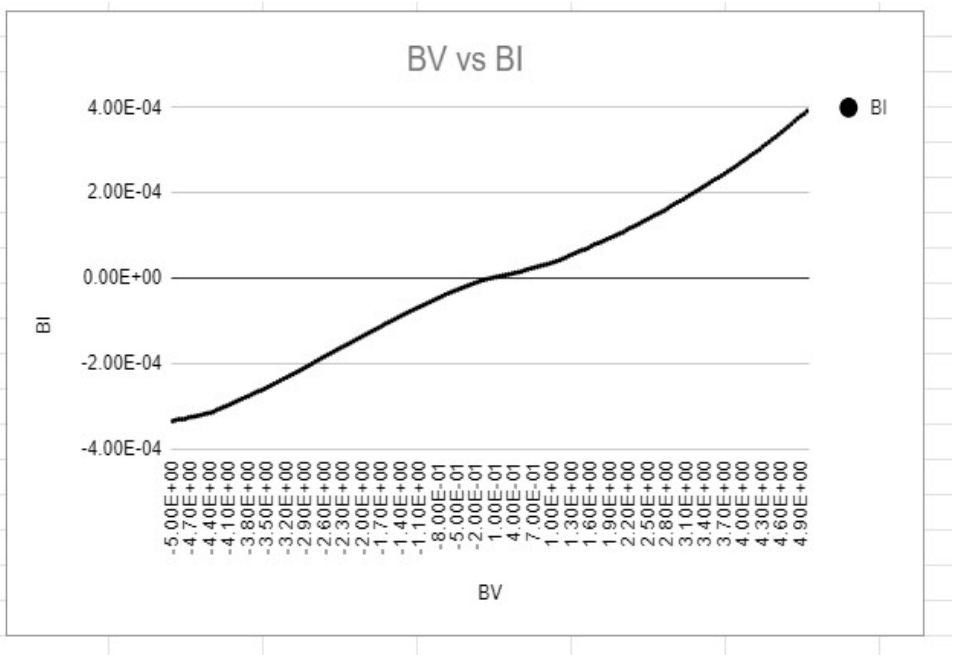
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After conducting the cryogenic treatment to the specimen, the results are obtained as below

Table 1. Result obtained after experimentation

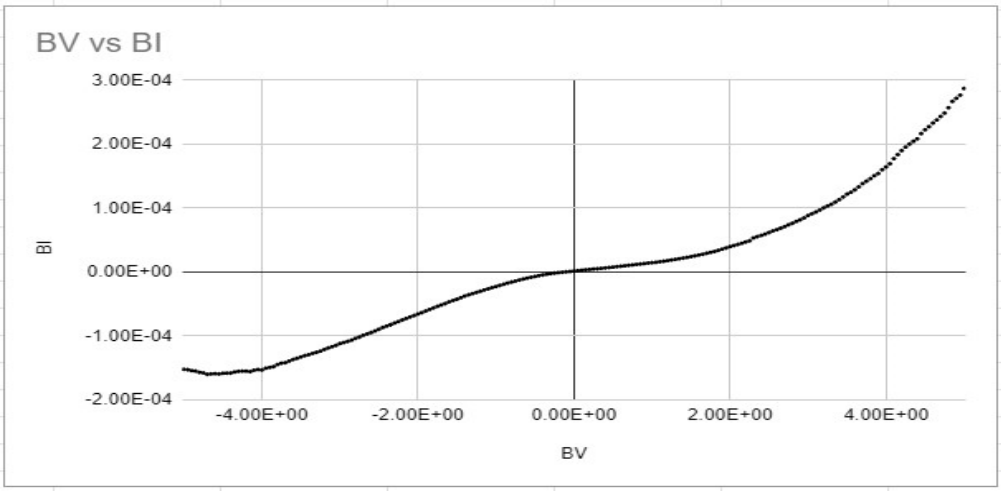
Sample No.	Parameter	Results before treatment	Result after cryogenic treatment
1.	Density	7.36	7.48
2.	Density	7.02	7.12
3.	Density	7.10	7.18
4.	Density	7.18	7.29
5.	Density	7.26	7.34

Graph: Before cryogenic treatment



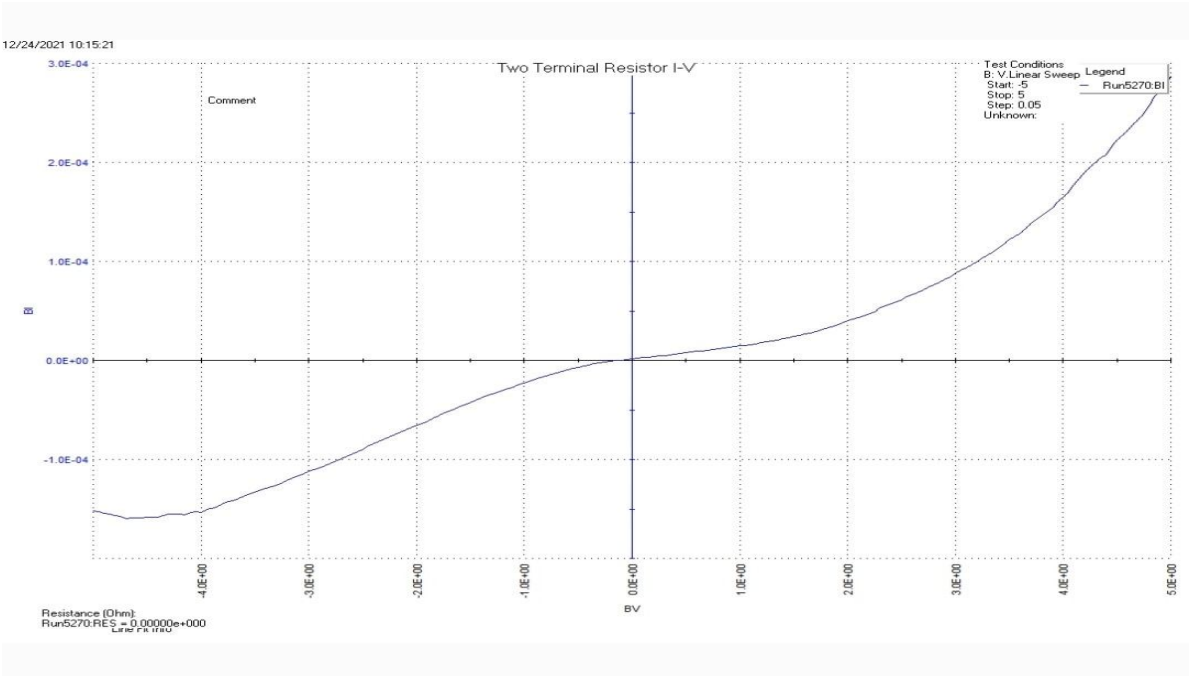
Graph 1. Current vs Voltage

Graph: After cryogenic treatment



Graph 2. Current vs Voltage

Following graph shows the effect of cryogenic treatment before and after the process on conductivity and resistivity of the material.



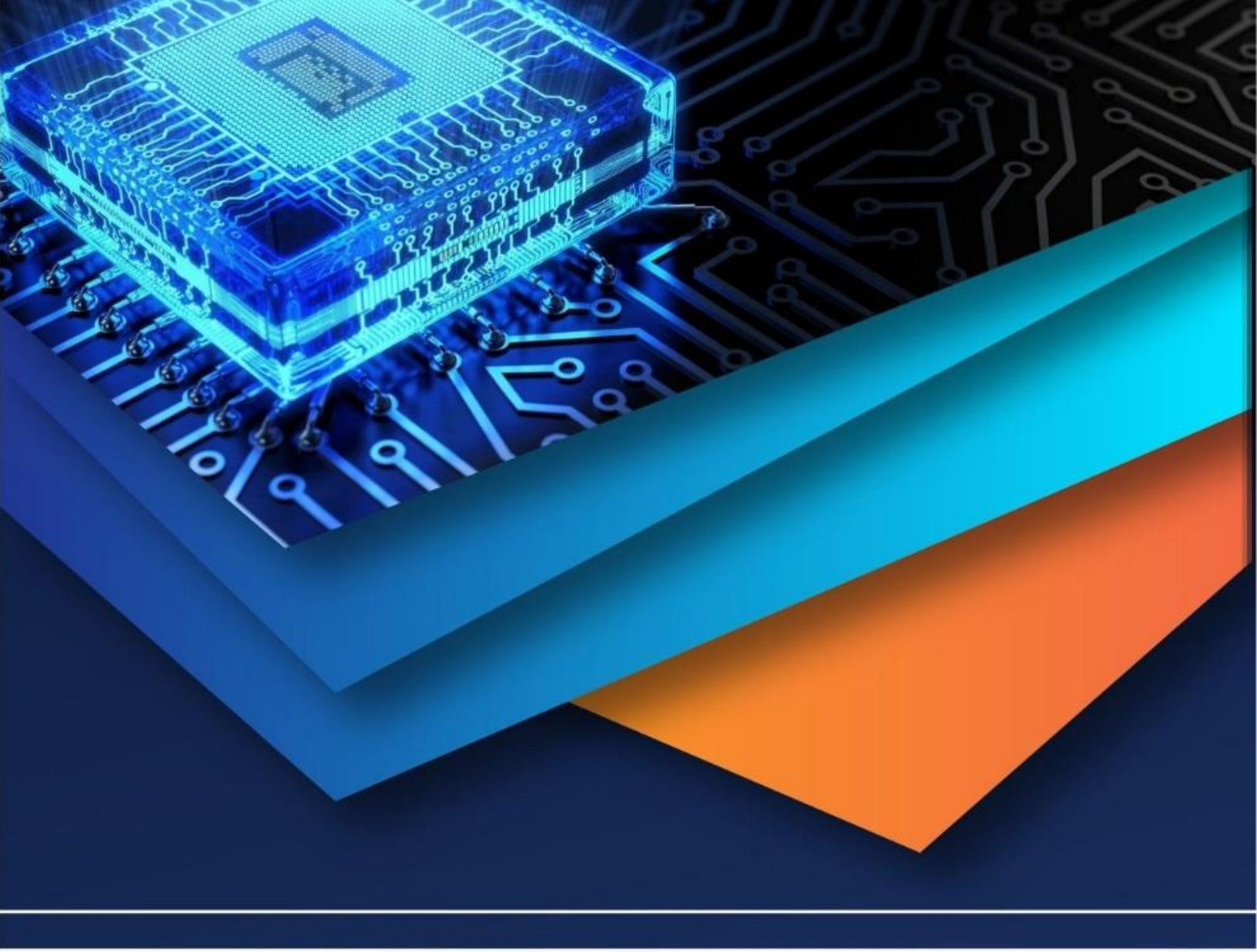
Graph 1.

IV. CONCLUSION

From the conducted cryogenics trials on the given specimen we come to a concluding remark that the material that is subjected to the cryogenic treatment shows a noticeable change in the density of the material than that of non cryogenic treated materials.

REFERENCES

[1] "Deep Cryogenic Treatment: A Bibliographic Review" By P. Baldissera*And C. Delprete, The Open Mechanical Engineering Journal, 2008, 2, 1-11
[2] "Effect of Cryogenic Treatment On The Mechanical Properties Of 4340 Steel" By S. Zhirafar A. Rezaeian, M. Pugh, Journal Of Materials Processing Technology 186 (2007) 298–303.
[3] " Cryogenic Treatment And It's Effect On Tool Steel" By T. Yugandhar, P.K. Krishnan, C.V. Bhaskar Rao And R. Kalidas, 6th International Tooling Conference
[4] "Study On The Characteristics Of A High Capacity Nickel Manganese Cobalt Oxide (NMC) Lithium-Ion Battery—An Experimental Investigation" By Ruifeng Zhang, Bizhong Xia Et Al , Energies 2018, 11, 2275; Doi:10.3390/En11092275



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