

# A Study on Fabric Properties Produced with Cotton Wrapped Copper Core Yarn

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**ABSTRACT:** This innovative experimental study is focused on the effect of cotton wrapped copper core yarn on different fabric properties like Electromagnetic Shielding Effectiveness (EMSE), Thermal Insulation Value (TIV), Air Permeability and Tensile properties. The 50's Ne cotton yarn is wrapped over the 40gauge and 38gauge copper wire on hollow spindle machine and cotton wrapped copper core yarns are produced. This wrapped yarns are used as weft material and 2/40's cotton yarn used as a warp material and the fabrics are produced on Dornier Rapier weaving machine with similar EPI, PPI and weave (plain weave). Another cotton woven fabric is produced on same machine with similar EPI, PPI and weave (plain weave). This three combinations (40gauge, 38gauge and cotton fabrics) are compared for their properties. The fabrics woven with 40 and 38gauge wrapped yarns shown very excellent EMSE as compared with cotton fabric as well as the 38gauge fabric shown better EMSE than the 40gauge fabric. In the case of TIV, the cotton fabric have more TIV as compared to 40 and 38 gauge fabrics and also the 40gauge fabric have more TIV compared with 38gauge fabric. The Air Permeability of both 40 and 38 gauge fabrics are more as compared with cotton fabric, also the 40gauge fabric shown more air permeability than 38gauge fabric. The weft way strength of 40 and 38 gauge fabrics are very high but in warp way it is less as compared with cotton fabric and 38gauge fabric is having more strength than 40gauge fabric. The weft way elongation of both 40 and 38 gauge fabrics are less than warp way elongation as well as it is less as compared with cotton fabric.

**KEYWORDS:** **40 gauge fabric** – fabric produced from cotton wrapped copper core yarn with the help of 40 gauge copper wire.

**38 gauge fabric** – fabric produced from cotton wrapped copper core yarn with the help of 38 gauge copper wire.

## I. INTRODUCTION

Today different types of pollutions are increasing day by day. As like a Water pollution, Air pollution and Sound pollution the electromagnetic waves pollution is also increasing. The Air, Water and Sound pollutions can easily visualized, analyzed, and can be easily controllable but the Electromagnetic Waves Pollution is un-visualize. The electromagnetic waves pollution is very hazardous for human health so it is necessary to control and protect from it. Metals like copper, silver, aluminum, stainless steel are one of the medium to control the electromagnetic waves because it does not allow to pass these waves. There for by using textile material with this metal we can shield the human body (heart) from the electromagnetic waves.

Textiles are used in everyday life, for example as garment to protect ourselves from heat or cold, fabrics covering the surfaces of floors, or the upholstery of car seats. On other hand electronic devices are spreading the electromagnetic waves but still many people do not have the knowledge to protect. So the next step to spread these electronics is to improve the user interfaces. Wearable electronics could offer improved interfaces and make it easier for the user to accept electronic devices in everyday life. The latest technological advances in new materials and devices enabled wearable system to be created by utilizing textile solutions. These solutions require electro-conductive yarns as basic component. Although the production of electro-conductive yarn is widely reported, research is still necessary to characterize them advance their electro – conductive and mechanical properties.

People use electrical equipment more frequently as science and technology continue to develop, exposing them to different frequencies of electromagnetic waves. Many devices contribute to such exposure as cell phones in the frequencies of 900 and 1800MHz, microwave ovens of 2450MHz, radar signal communication system extending from 1 to 10,000MHz, FM/AM radio broadcasts of 30-300MHz and 300-3000KHz, respectively. Cell phone use has been particularly wide spread in recent years. When electromagnetic waves get into an organism, they vibrate molecules too and generate heat. In the same way, when an electromagnetic wave enters into human body, it vibrates body molecules,



generates heat, and obstructs cell’s DNA and RNA regeneration function. Furthermore, it induces abnormal chemical activities contributing to increase in leukemia and other forms of cancer. Injuries by the electromagnetic waves to the human body are of outmost concern to everyone.

**1.2 OBJECTIVES:-**

- 1) To produce cotton yarn wrapped copper core yarn.
- 2) To produce fabric with the help of this cotton wrapped copper core yarn.
- 3) To characterize the manufactured fabric for different properties.

**1.3 SCOPE OF STUDY:-**

In case of electro-conductive yarns have been used in various industrial application for the purpose of controlling static and electromagnetic interference shielding. Now a day this yarns are used to development of electronics and smart textile to develop wearable. This innovative study is carried out to produce the cotton wrapped copper core yarn which can be used to produce woven wearable fabric which is act as a electromagnetic shield and it can be used as to protect us from electromagnetic waves. Also the copper is good conductor of heat so it can be used as to control the heat of human body.

**1.4 PLAN OF WORK**

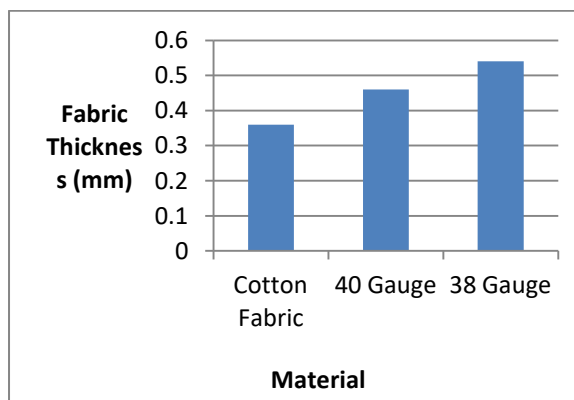
**INTRODUCTION**

To accomplish the objectives of these experiment this literature survey was carried out. From this we got one of the line directions for to do the innovative experiment which is not carried out earlier. With the help of this Literature review the plan of work for this experiment work is prepared.

**1.5 RESULTS AND DISCUSSION**

**1. Effect of different type of yarns on fabric thickness –**

	COTTON FABRIC	40 GAUGE FABRIC	38 GAUGE FABRIC
AVG	0.36	0.46	0.54

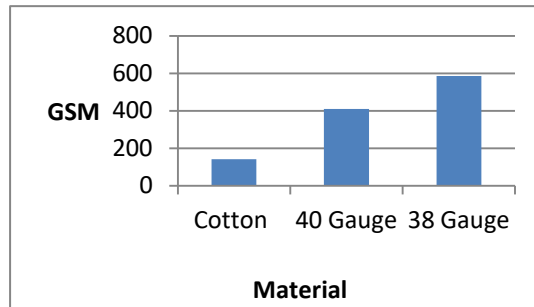


From the table and graph, the effect of different types of yarns on fabric thickness can be seen clearly. In the statistical finding by one-way ANOVA without replication there is significant effect of types of yarns on fabric thickness. From the correlation and seeing to the trend line 40gauge and 38gauge fabrics having more thickness than cotton fabric, as well as the 38gauge fabric shows more thickness than 40gauge fabric it is due to 38 gauge wrapped yarn is coarser than 40gauge wrapped yarn.



**2. Effect of different type of yarns on fabric GSM -**

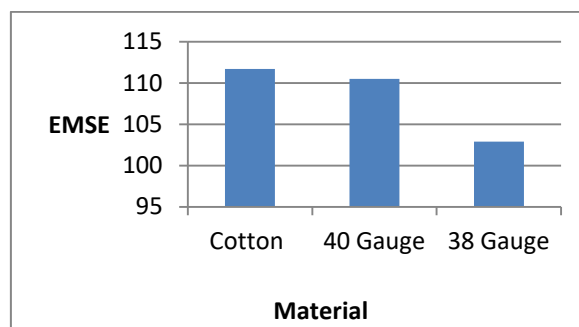
	Cotton	40gauge	38gauge
Avg.	141.52	410.6	585.04



The observations and graph shows the effect of different types of yarns on fabric gsm The statistical finding by one-way ANOVA without replication also shows that there is significant effect of types of yarns on fabric gsm. Of being course a metal covered yarn and 38 gauge copper yarn fabric have shown the maximum gsm than any other.

**Effect of different type of yarns on fabric EMSE (warp way) -**

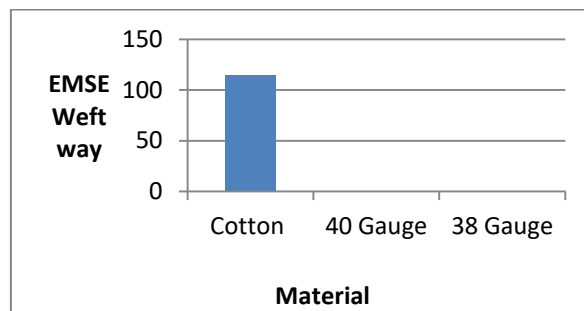
	COTTON FABRIC	FABRIC (40gauge)	FABRIC (38gauge)
Avg.	111.7	110.5	102.9



The observations and graph shows the effect of different types of yarns on warp way fabric EMSE. In the statistical finding by one-way ANOVA without replication there is significant effect of types of yarns on warp way fabric EMSE. From the correlation and seeing to the trend line 40gauge and 38gauge fabrics having less warp way Amplitude than cotton fabric. The 38gauge fabric shows list warp way amplitude than 40gauge fabric so 38gauge fabric shows very excellent EMSE values than 40gauge fabric. It is due to 38gauge wrapped yarn is coarser than 40gauge wrapped yarn In warp way direction cotton fabric reduces only 9.91 % strength of electromagnetic waves. The 40gauge fabric reduces 10.88 % strength of electromagnetic waves and 38gauge fabric reduces 17.01 % strength of electromagnetic waves. and also more amount of copper content in 38gauge fabric.

**Effect of different type of yarns on fabric EMSE (weft way) :**

	COTTON FABRIC	FABRIC (40gauge)	FABRIC (38gauge)
Avg.	114.1	0	0



The observations and graph shows the effect of different types of yarns on weft way fabric EMSE. In the statistical finding by one-way ANOVA without replication there is significant effect of types of yarns on weft way fabric EMSE. From the correlation and seeing to the trend line 40gauge and 38gauge fabrics having less weft way Amplitude than cotton fabric. Also the 38gauge fabric shows very less weft way amplitude than 40gauge fabric so 38gauge fabric shows very excellent EMSE values than 40gauge fabric it is due to 38gauge wrapped yarn is coarser than 40gauge wrapped yarn and also more amount of copper content in 38gauge fabric. In weft way direction cotton fabric reduces only 7.1 % strength of electromagnetic waves. The 40gauge fabric reduces 0 % strength of electromagnetic waves and 38 gauge fabric reduces 0 % strength of electromagnetic waves.

**II.CONCLUSION**

From this innovative experimental work following conclusion are made -

- 1) The fabric thickness and gsm test result shows 40gauge and 38gauge fabrics having more thickness and gsm than cotton fabric, as well as the 38gauge fabric shows more values than 40gauge fabric.
- 2) In the case of tensile strength and elongation properties no clear trend is observed warp way while weft way it shown maximum tensile strength to 100% cotton yarn fabric then the covered yarns. 38 gauge fabric shown the list tensile strength
- 3) In the Electromagnetic Shielding Effectiveness (EMSE) test, the 40gauge and 38gauge fabrics having more warp way EMSE than cotton fabric. Also the 38gauge fabric shows more warp way EMSE than 40gauge fabric it is due to 38gauge wrapped yarn is coarser than 40gauge wrapped yarn and also more amount of copper content in 38gauge fabric.
- 4) In the case of weft way Electromagnetic Shielding Effectiveness (EMSE the 40gauge and 38gauge fabrics having very excellent weft way EMSE than cotton fabric in both the types of tests.
- 5) As the test results gives EMSE values as zero at 0.10 Hz frequency and 124 milli volt input amplitude it gives zero output amplitude and at 700 MHz frequency and 67.4 db micro volt input amplitude it gives 5-9 db micro volt amplitude these fabrics can be used for lower frequency range (0.10Hz to 700 MHz or more than 700 MHz) applications like to protect human body, Radar signal communication system, Cell phones, FM radio broadcast, Household applications, civil construction.

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