

# THE FUTURE OF COARSE-GRADE WOOL: CREATING VALUE-ADDED PRODUCTS THROUGH COMPOSITE TECHNOLOGY

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**Abstract:** This study is focused on the comprehensive analysis of the potential for enhancing the utility and value of coarse-grade wool in Pakistan through the development of wool-reinforced composites. Pakistan, a country with vast natural resources, has seen a decline in its wool industry due to various economic factors, including the importation of fine-grade wool, and the lack of awareness regarding the value added products. This study focuses on the revival of the local wool sector by optimizing the processing of local wool for fabricating sheets by non-woven technology, which are then used to develop composites for various applications, including thermal insulation, moisture retention, sound absorption, filtration, and fire retardancy. The research involves preparing different composite samples with varying amounts of wool fiber, resin, and filler, including aluminum powder and metal oxides. The study finds that increasing the volume fraction of wool fiber in the composites enhances infrared (IR) absorption, reduces IR transmission, and improves the materials' tensile strength to a certain point. Notably, the addition of fillers such as zinc oxide, aluminum oxide, titanium oxide, and aluminum particles significantly boosts the composites' IR absorption properties and tensile strength, although the strength of titanium oxide and aluminum particles is lower compared to the aluminum oxide composite. A key finding is that the coefficient of thermal expansion increases with the wool volume fraction, and while the addition of wool fiber generally increases tensile strength, there is an optimal fiber content (0.25%) beyond which the tensile strength decreases. The research suggests a pathway for reviving the wool industry in Pakistan by developing value-added products from locally sourced wool, thereby leveraging the country's natural resources for economic and industrial benefits.

**Keywords:** composite, filler, non-woven, wool

## INTRODUCTION

Wool is considered as a precious natural fiber, used for a long time as a textile raw material [1]. Sheep wool is curled and having scales which is heavier and keep the body warm from wind. It helps to protect the body from cold and heat from the outside. Wool has Natural antibacterial, antimicrobial, UV-blocking, and insulating properties [2]. Pakistan's economy majorly depends on the production of livestock and crop farming [3]. Globally, 995 sheep breeds have been reported, where Asia is sheltering 265 (27%) sheep breeds. According to the Pakistan economic survey,

the Sheep population in Pakistan was 29.4 million which yields 44.1 million wool fibers [4].

## RESULTS AND DISCUSSION

All the data related to the tensile strength values have been shown in the following Figure 1. It is clear from the figure that as we increase the content of wool fibre in the samples (1 to 6), the value of tensile strength increases considerably and after a considerable increment it tends to go downwards. It also means that the optimized values of tensile strength may be achieved till the wool fibre content of 0.25 %.

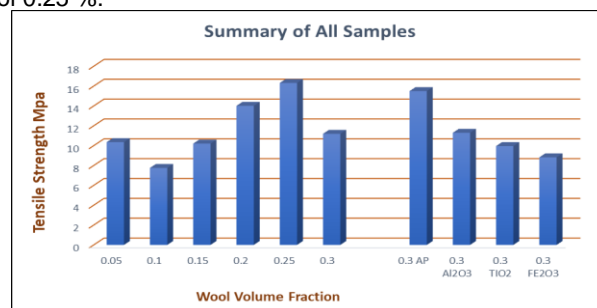


Figure 1 Impact of wool on the strength

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