

Effect of Expanded Graphite on the Thermal Conductivity of Textile-Based Composites

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Abstract: Graphite and specifically the graphene it is comprised of is seen as a material of the future due to its superior conductive properties. Its mechanism of conduction by electron transport through the sp^2 hybridised carbon atoms sp^2 that make up the graphene layers is the reason for this high electrical and thermal conductivity. Expanded graphite is produced by rapid expansion of intercalated graphite to produce graphite particles with high porosity. This high porosity should provide thermally insulative properties to the expanded graphite particles and thus reducing its overall thermal conductivity. The effect of expanded graphite on the thermal conductivity of textile-based composites was studied.

Keywords: expanded graphite, composite, thermal conductivity, thermal insulation.

Expanded graphite has shown remarkable conductive properties and has been researched more in recent years for potential applications such as oil and gas sorption, battery technology and flame retardant thermal applications [1], [2], [3]. Typically, expanded graphite is produced by intercalating graphite particles with acids such as sulfuric- or nitric acid in the presence of hydrogen peroxide. This is then dried and heated to around 700 °C - 900 °C which causes the intercalated acid to expand rapidly resulting in an expansion between the graphite layers of the intercalated graphite [4]. This results in a worm-like structure as illustrated in figure 1.

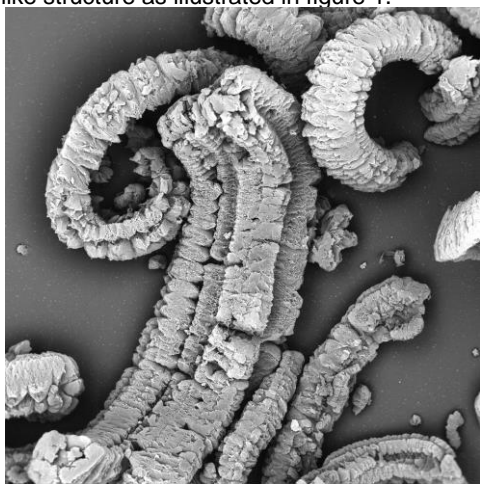


Figure 1: Scanning electron microscope image of expanded graphite.

Although expanded graphite is an excellent conductor of heat it is suggested that as a particle in air it should act as an insulator due to the large porosity of the particle structure. This insulation effect is expected to be

enhanced due to spacing between particles provided by the shape distortion during expansion.

For this experiment expanded graphite in varying amounts was sandwiched between two spun bond polypropylene materials to form pillow-like structures and the thermal conductivity was measured.

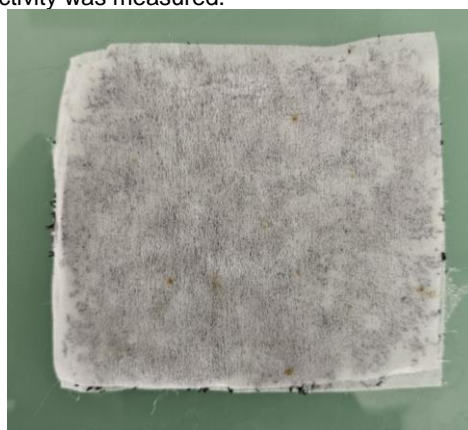


Figure 2: Expanded graphite/polypropylene pillow.

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