NONWOVEN FABRIC. MICROWAVE ABSORPTION PROPERTIES OF CARBON FIBER CONTAINING NONWOVENS

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Nonwoven fabric is a fabric-like material made from long fibers, bonded together by chemical, mechanical, heat or solvent treatment. The term is used in the textile manufacturing industry to denote fabrics, such as felt, which are neither woven nor knitted. [2] Some nonwoven materials lack sufficient strength unless densified or reinforced by a backing.

Nonwoven fabrics are broadly defined as sheet or web structures bonded together by entangling fiber or filaments (and by perforating films) mechanically, thermally or chemically. They are flat or tufted porous sheets that are made directly from separate fibers, molten plastic or plastic film. They are not made by weaving or knitting and do not require converting the fibers to yarn. Typically, a certain percentage of recycled fabrics and oil-based materials are used in nonwoven fabrics. The percentage of recycled fabrics vary based upon the strength of material needed for the specific use. In addition, some nonwoven fabrics can be recycled after use, given the proper treatment and facilities. For this reason, some consider nonwovens a more ecological fabric for certain applications, especially in fields and industries where disposable or single use products are important, such as hospitals, schools, nursing homes and luxury accommodations.

A variety of nonwoven containing different weight percentages of pitch-based carbon fibre has been developed using through-air thermal bonding process or the spray bonding process and studied for its microwave absorbing capacity in the microwave frequency range 8 - 18GHz. Microwave reflectivity of the nonwoven is found closely related to the carbon fibre content. Electromagnetic parameters of the component fibres in the nonwoven have also been studied. Variation in microwave absorbing capacity of the nonwoven with the carbon fibre content is expounded

according to the relationship between the electromagnetic parameters and the reflection coefficient of the nonwoven, as well as the relationship between the electromagnetic parameters and the attenuation constant of the nonwoven. The carbon fibre containing nonwoven has great potential in the military application as the radar camouflage material or in the non-defense application as the electromagnetic shielding material.

With the development of radar reconnaissance technology, military applications require high performance camouflage materials with light weight and at low cost over a broad frequency band. This can be achieved by many ways, one of which is by designing and optimizing textiles reinforced by microwave absorbing fillers since it is easier to manufacture textiles in large scale and at a lower cost than most other camouflage materials. Furthermore, it is also easy to process textiles by various means to endow them with multiple camouflage properties.

Nonwoven textiles having variable thicknesses can be more easily manufactured in comparison to other textiles. It is found that only those materials which have enough thickness exhibit high microwave absorption capacity. There have been some reports published on the microwave absorption properties of the nonwoven. Lopes et al.[1, p 391] reported the microwave properties of nonwovens impregnated with conductive carbon black at the X-band (8.2-12.4 GHz). It has been found that the absorption effectiveness of the nonwoven depends on the filler concentration. The nonwoven containing 33wt% of carbon black shows the best absorption. This property is expounded on the basis of the theory1 whether the conductive filler loading is below or above the threshold of conductivity. However, the impregnated nonwoven shows poor mechanical properties, air permeability and handling, which limits its application in adverse environment. The nonwoven fabricated with viscose-based carbon fibre and polypropylene fibre was investigated by Zhang et al [3, p 47]. They found that the microwave reflection and the transmission properties of the nonwoven vary with the change of carbon fibre content in the nonwoven. It is also reported that when the carbon fibre content in the nonwoven increases from 5.1g/m2 to 19.8g/m2, the reflected microwave by the nonwoven increases and the transmitted wave decreases. By comparing the reflected

wave of the nonwoven with that of a certain camouflage net material, it is concluded that a part of the electromagnetic wave is absorbed by the carbon fibre.

LIST OF LITERATURE

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