

EXPLOSION-PROOF TEXTILE WITH HIERARCHICAL STEINER TREE STRUCTURE

by

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The aim of the current work is to propose a new idea to design of explosion-proof textile where the Steiner tree with hierarchical structure is adopted.

Key words: *Explosion-proof, Steiner tree structure, fractal, fractional calculus*

1. Introduction

The textile with Steiner tree structure is the most stable and suitable for explosion protection[1,2]. At the initial stage of any explosions, the velocity of debris tends to zero, and due to the flexibility of the textile, the debris can be easily captured. In our previous work[2] we analyzed stability of the textile with Steiner tree structure, and this paper suggests a novel structure to capture various debris with different sizes.

2. The Explosion-proof Textile with Hierarchical Steiner Tree Structure

The textile with Steiner tree structure is shown in Fig.1. When such textile is adopted in explosion protection, the debris smaller than the hole of the textile might fly outside.

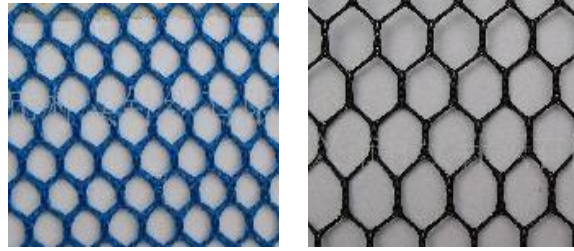


Fig.1 Textile with Steiner tree structure

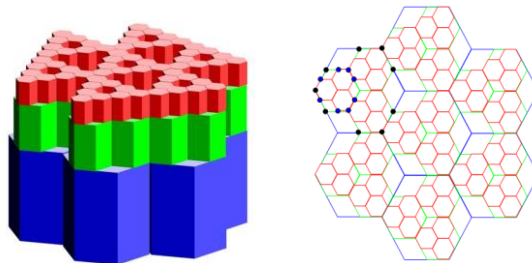


Fig.2 Textile with hierarchical Steiner tree structure

To block fragments of different sizes, we use a hierarchical structure as illustrated in Fig.2. The innermost layer is the smallest mesh (which can be as small as nano-holes), the outermost one is the

largest mesh. On the whole, the textile of each layer has regular Steiner tree structure. It can block the debris with various sizes.

3. Discussion and Conclusion

The failure process of the explosion-proof textile with hierarchical structure is of a fractal pattern, which also arises in the failure process of materials with a disordered microstructure[3]. Carpinteri et al.[3] found that fractional calculus can best describe the fractal quantities of the such failure process, and we will establish a similar model later.

This paper proposes a new idea to explosion-proof textile, and some experimental verification is needed to validate the model.

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