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Porous carbon fibers for electromegnetic wave absorption

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Abstract

Modern warfare urgently needs radar stealth technology to meet the shelter requirements of weapons and equipment. In this paper, porous carbon fibers were developed as an efficient microwave absorbent filler to prepare microwave absorbing composites. Firstly, polyacrylonitrile (PAN) was used as carbon precursor polymer (CPP), while polymethyl methacrylate (PMMA) as thermally decomposed polymer (TDP). PAN/PMMA (70/30) blend fibers were prepared by a wet spinning of PAN/PMMA solutions. Secondly, Porous carbon fibers (PCF) were obtained through carbonization of the blend fibers. The molecular weight of PAN could be used to control the size of pores in PCF, that is, when the average molecular weight of PAN was 51,000 g/mol and 83,000 g/mol respectively, PCF with pores ranging 1-10μm in diameter (designated PCF-L); and the other one with pores with diameter in the range of 0.1-1 μm (designated PCF-S) were obtained. The resultant porous fibers, PCF-L and PCF-S, were used as microwave absorbing fillers to mix with epoxy respectively, the composites containing 2-6 wt% of the filler were fabricated. It was found that PCF-S filled composites showed much better microwave absorption performance than that PCF-L filled one. The composite containing 6 wt% of PCF-S reached the lowest reflection loss of -32dB; and the reflection loss below -10 dB covered the whole X band. The change or destruction of the porous structure in PCF showed great effect on the microwave absorption properties, which demonstrate that the pores in PCF could make great contribution to the microwave absorption.