UltraHigh Performance EMI Shielding Materials of Thermal Reduced Graphene Aerogel/PDMS Nanocomposites

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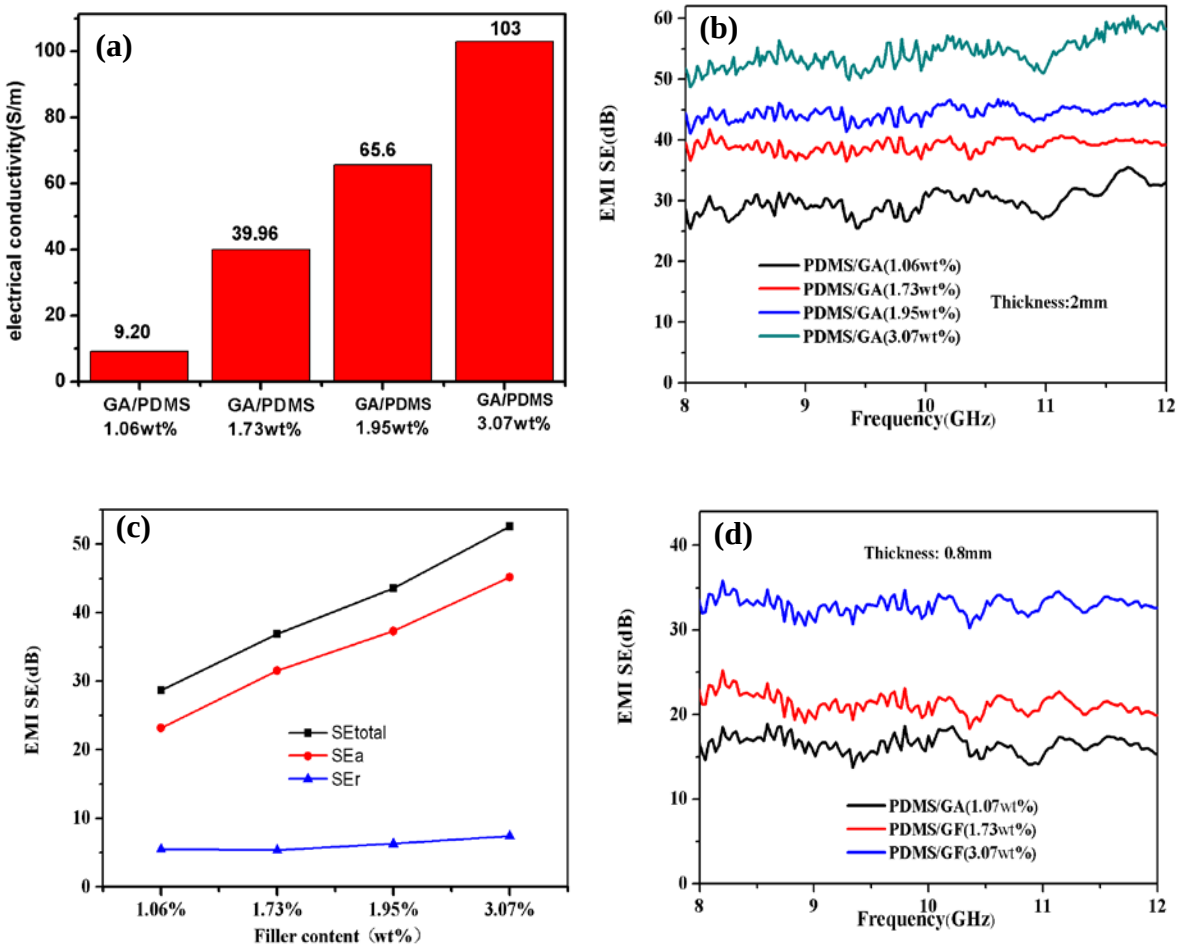
ABSTRACT

There generate severe electromagnetic interference and emit much radiation by the integrated circuits, which greatly impact the surrounding environment and even the human health. Many efforts have been devoted to fabricate carbon-filler polymer nanocomposites, especially the carbon nanotube and graphene. Though many reported have reported the carbon nanotube or graphene polymer composites for EMI shielding performance. But if want to achieve a high EMI shielding performance, high loading of carbon filler is needed or utilized the CVD method. However these methods will at the cost of the other performance of the materials, such as mechanical property. Besides increase the cost or complexity of the fabrication procedure. Though some reports utilize graphene sheets to act as carbon filler to fabricate nanocomposites for EMI shielding. The graphene sheets always random stack or aggregating together, resulting a poor shielding performance. Our reports focused on a simple and effective method to prepare polymer EMI shielding materials with graphene acting as filler, which not only deal with the disperse method but also was suited for commercial production. Recently, many reports have demonstrated that scientists have fabricated

carbon based 3D interconnected frameworks to prepare functional polymer composites and achieved a great results. 3D monolithic graphene framworks (graphene aerogel, GA) with the graphene oxide as raw material prepared by facile freeze-drying process, followed by chemical reduction and thermal reduced. After that, PDMS is incorporated into GA by directly vacuum-assisted infiltration method to prepare 3D GA/PDMS nanocomposites. At these work, a novel method was utilized to tune the density of the original GA. GA with different height at the original density of 10mg/cm^{3,} was pressed to a same height to fabricate the GA/PDMS nanocomposites with different GA loading of GA/PDMS nanocomposites. From the SEM images, the graphene sheets dispersed into the PDMS polymer matrix uniformly. The nanocomposites showed excellent electrical conductivity and EMI SE property. A remarkable conductivity of 103S/m and an high-performance average EMI SE of 54.26dB at the thickness of 2mm in the 8-12GHz were achieved at the loading of 3.07wt%, which is among the best values for polymer nanocomposites with carbon fillers, especially among the polymer nanocomposites with the chemically-derived graphene as the fillers. Even at the thickness of 0.8mm, the average EMI shielding-performance of the nanocomposites can reach 32.94dB at the content of 3.07wt%. These excellent performance was attributed to the excellent three-dimension conductive network incorporated into the PDMS polymer matrix. After analysised the EMI-shielding mechanism, the absorption EMI shielding value is much higher than reflection EMI shieling value in the frequency range of 8-12GHz, confirming the absorption-dominant mechanism. It should be noted that we fabricated the highly

conductive and high absorption-dominant EMI-shieling materials.

FIGURES AND TABLES



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