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Letter

Electromagnetic interference shielding in X-band with aero-GaN

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Abstract

We investigate the electromagnetic shielding properties of an ultra-porous lightweight nanomaterial named aerogalnite (aero-GaN). Aero-GaN is made up of randomly arranged hollow GaN microtetrapods, which are obtained by direct growth using hydride vapor phase epitaxy of GaN on the sacrificial network of ZnO microtetrapods. A 2 mm thick aero-GaN sample exhibits electromagnetic shielding properties in the X-band similar to solid structures based on metal foams or carbon nanomaterials. Aero-GaN has a weight four to five orders of magnitude lower than the weight of metals.

Keywords: electromagnetic interference shielding, aero-GaN, microwaves

(Some figures may appear in colour only in the online journal)

1. Introduction

Electromagnetic interference shielding (EMI) is a crucial issue, since many devices emit electromagnetic (EM) waves and thus have detrimental effects on computers, cell phones, wireless internet and very sensitive equipment such as navigation systems. The reduction of EMI and radar-cross section becomes critical when dealing with millions of small objects which are interconnected by high-frequency EM fields, as in the case of Internet-of-Things. Much lighter EMI shielding materials are required for many applications, especially in the domains of automotive and aerospace.

The X-band is one of the most important EM bands (8.2–12.4 GHz) since the majority of radars work in this band, it is also allocated for terrestrial and space communications. Even traffic light motion sensors and RF sources of particle accelerators operate in this frequency range. Therefore, EMI shielding is of utmost importance in the X-band, different lightweight materials have been investigated for EMI shielding such as conducting polymers, graphene, carbon nanotubes and nanocomposites based on them [1]. The search for new EMI shielding materials has lasted for at least two decades, microwave absorbers have been studied using carbon nanotubes (CNTs) in X-band [2], CNT-based composites [3], carbon nanotube networks [4] and doped carbon nanotubes [5]. A recent review about CNT composites for EMI shielding is found in [6]. Lightweight graphene foam composites have emerged as a strong EMI shielding material candidate in the X-band due to their low densities of 0.06 g cm^{-3}, which is 20 times smaller than that inherent to polymer composites [7]. Lower densities of 0.008 g cm^{-3} and very good EMI shielding are obtained with the help of graphene foams and polymer

