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Communication

Aero-Ga_2O_3 Nanomaterial Electromagnetically Transparent from Microwaves to Terahertz for Internet of Things Applications

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Received: 4 May 2020; Accepted: 27 May 2020; Published: 29 May 2020

Abstract: In this paper, fabrication of a new material is reported, the so-called Aero-Ga_2O_3 or Aerogallox, which represents an ultra-porous and ultra-lightweight three-dimensional architecture made from interconnected microtubes of gallium oxide with nanometer thin walls. The material is fabricated using epitaxial growth of an ultrathin layer of gallium nitride on zinc oxide microtetrapods followed by decomposition of sacrificial ZnO and oxidation of GaN which according to the results of X-ray diffraction (XRD) and X-ray photoemission spectroscopy (XPS) characterizations, is transformed gradually in β-Ga_2O_3 with almost stoichiometric composition. The investigations show that the developed ultra-porous Aerogallox exhibits extremely low reflectivity and high transmissivity in an ultrabroadband electromagnetic spectrum ranging from X-band (8–12 GHz) to several terahertz which opens possibilities for quite new applications of gallium oxide, previously not anticipated.

Keywords: aero-Ga_2O_3; ultra-porous nanomaterial; extremely low reflectivity; electromagnetically transparent nanomaterial; X-band and terahertz frequencies

1. Introduction

The materials transparent for a certain electromagnetic bandwidth are key components for many industries such as aeronautic, space, telecommunications, etc. [1,2]. They are called radomes and are configured in the form of various enclosures depending on the applications; their role is to protect antennas from various agents such as rain, snow, dust, heat, etc. The radomes can be seen, for example,