

Wide bandgap aeromaterials and prospects for their applications —

•VLADIMIR CIOBANU, TUDOR BRANISTE, EDUARD MONAICO, and ION TIGINYANU — National Center for Materials Study and Testing, Technical University of Moldova, Chisinau, Moldova

We report on the fabrication of aeromaterials based on GaN, Ga₂O₃, TiO₂ and Zn₂TiO₄ using hydride vapor phase epitaxy (HVPE) or Atomic Layer Deposition (ALD) approaches. The fabrication process is based on growth of the preferred material on sacrificial templates consisting of interconnected ZnO microtetrapods. During the epitaxial growth of GaN at high temperatures and corrosive environment, the ZnO is etched away and, consequently, hollow microtetrapods with the wall thickness of the tubes in the range of 20 - 100 nm are obtained. Further, GaN can be transformed into Ga₂O₃ through an annealing process at temperature as high as 800 °C. Alternatively, ALD approach is used to fabricate aero-TiO₂ or aero-Zn₂TiO₄ materials using sacrificial ZnO templates.

The fabricated materials demonstrated new interesting properties: aero-GaN exhibits good electromagnetic shielding in X-band and THz region, on the other hand aero-Ga₂O₃ is completely transparent at GHz and THz frequencies, up to 3 THz. We also established that aero-GaN is characterized by dual hydrophilic-hydrophobic behavior. This phenomenon enabled one to demonstrate novel liquid marbles. Due to high active surface area of developed aero-Ga₂O₃ decorated with noble metal nanodots, aero-TiO₂ and aero-Zn₂TiO₄, these materials are shown to be promising for photocatalytic applications.