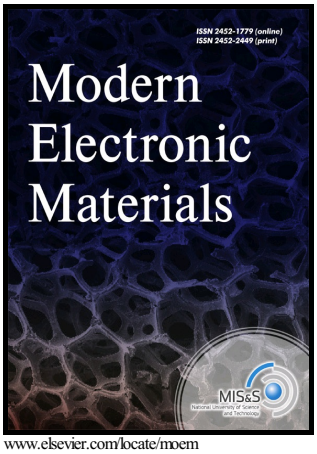

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Trends in the development of the epitaxial nitride compounds technology

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Abstract. The main trends in the development of technology for nitride heterostructures element base of microwave-technology and power electronics, as well as light-emitting diodes have been reviewed. It has been noted that most modern technological focus is the development of nitride heterostructures on silicon substrates. The basic problems of nitride compounds on silicon substrate and the ways of their solution have been discussed. Some results of GaN/Si heterostructures technology development in «Elma-Malachit» JSC have been presented. The AlGaN/GaN/Si heterostructures have been grown by MOCVD. We show that early process stages such as Si-surface treatment and Al pre-deposition are of great importance for the growth of crack-free structures with good structural and surface quality. Meanwhile the surface curvature of the grown structures is influenced mainly by the composition of the multilayered transition region between the AlN nucleation layer and the GaN layer. Transistors fabricated on AlGaN/GaN structures grown on Si substrates under optimized conditions demonstrated rather good static characteristics: $I_{d,max}$ = 800 mA/mm, U_{br} > 120 V, g_m = 170 mS/mm.
For further technology development experimental and technological work should be arranged in close coordination with analytical prediction and calculation of properties of the grown material with mathematical modeling methods. This approach will help enhance the efficiency of technology development and deepen scientific views on the processes responsible for the formation of properties of heterostructures.

Key words: gallium nitride, silicon carbide, silicon, supphire, heterostructure, substrate, heteroepitaxy, technology.

Introduction

For more than one and half decades serious attention in electronics has been paid to the development of the elemental base for RF devices and high-power electronics on the basis of nitride compounds of 3rd group elements. The development of these devices (Fig. 1) is necessitated by the need for the implementation of new higher frequency ranges increasing their power and linearity of characteristics as well of the improvement of their efficiency [1, 2].

Fig. 1. Applications of different semiconductors in RF systems [2].

Currently the fabrication of gallium nitride base devices is nearly commercial. It is considered in all the industrially developed states as a mainstream providing not only for the improvement of device