Nitridation of Unreconstructed and Reconstructed $(\sqrt{31}\times\sqrt{31})$ R ± 9° (0001) Surface of Sapphire in a Flux of Ammonia

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Данная работа посвящена изучению процесса нитридизации нереконструированной и реконструированной $(\sqrt{31}\times\sqrt{31})$ R ± 9° поверхностей (0001) сапфира в потоке аммиака, методом диффракции быстрых электронов на отражение. На нереконструированной поверхности (1 × 1) происходит нитридизация сапфира, приводящая к образованию кристаллической фазы AlN на поверхности подложки. Однако на реконструированной $(\sqrt{31}\times\sqrt{31})$ R ± 9° поверхности сапфира кристаллическая фаза AlN в процессе нитридизации не образуется.

Sapphire substrates are widely used for epitaxial growth of A3-nitrided heterostructures. To reduce the influence of the mismatch of the lattice parameters sapphire substrate and nitrides, the surface is kept in a stream of ammonia at elevated temperatures before forming a crystalline phase of AlN – nitridation process. Then we form the embryonic and buffer layers.

The experiment consisted in nitridation of the unreconstructed and reconstructed $(\sqrt{31}\times\sqrt{31})$ R ± 9° sapphire surface. Registration of nitridation process was performed by recording video movies by a CCD camera from a luminescent screen in azimuthal continuous and uniform rotation of the substrate and comparing the diffraction patterns in order to detect the presence of the crystalline phase of AlN after treating substrates with ammonia. In the case of reconstructed surface $(\sqrt{31}\times\sqrt{31})$ R ± 9° the samples were heated to temperature of 1150 °C. The unreconstructed and reconstructed surfaces were exposed to the flow of ammonia of 25 standard. cm^3/min for 30 minutes at temperature of 840 °C.

Experiments have shown that successful nitridation of a sapphire substrate (0001) in a MBE requires an unreconstructed surface. Studies have also shown that exposure of the reconstructed surface $(\sqrt{31}\times\sqrt{31})$ R ± 9 ° does not lead to the formation of the crystalline phase AlN in MBE, from which it follows that the reconstructed surface is more resistant to ammonia.