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(54) **PENDEOEPITAXIAL METHODS OF FABRICATING GALLIUM NITRIDE SEMICONDUCTOR LAYERS ON SILICON CARBIDE SUBSTRATES BY LATERAL GROWTH FROM SIDEWALLS OF MASKED POSTS, AND GALLIUM NITRIDE SEMICONDUCTOR STRUCTURES FABRICATED THEREBY**

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This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

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(51) **Int. Cl.**^{7} **H01L 21/20**

(52) **U.S. Cl.** **438/479**

(58) **Field of Search** 438/22, 24, 39, 438/40, 41, 42, 43, 44, 46, 47, 478, 503, 507, 481, 483

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(57) **ABSTRACT**

An underlying gallium nitride layer on a silicon carbide substrate is masked with a mask that includes an array of openings therein, and the underlying gallium nitride layer is etched through the array of openings to define posts in the underlying gallium nitride layer and trenches therebetween. The posts each include a sidewall and a top having the mask thereon. The sidewalls of the posts are laterally grown into the trenches to thereby form a gallium nitride semiconductor layer. During this lateral growth, the mask prevents nucleation and vertical growth from the tops of the posts. Accordingly, growth proceeds laterally into the trenches, suspended from the sidewalls of the posts. The sidewalls of the posts may be laterally grown into the trenches until the laterally grown sidewalls coalesce in the trenches to thereby form a gallium nitride semiconductor layer. The lateral growth from the sidewalls of the posts may be continued so that the gallium nitride layer grows vertically through the openings in the mask and laterally overgrows onto the mask on the tops of the posts, to thereby form a gallium nitride semiconductor layer. The lateral overgrowth can be continued until the grown sidewalls coalesce on the mask to thereby form a continuous gallium nitride semiconductor layer. Microelectronic devices may be formed in the continuous gallium nitride semiconductor layer.

39 Claims, 4 Drawing Sheets