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(54) **METHODS OF FORMING A PLURALITY OF SEMICONDUCTOR LAYERS USING SPACED TRENCH ARRAYS**

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(58) **Field of Search** 438/478, 479, 438/480, 481, 483, 412, 460, 462, 931; 257/76

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(57) **ABSTRACT**

Methods of forming compound semiconductor layers include the steps of forming a plurality of selective growth regions at spaced locations on a first substrate and then forming a plurality of semiconductor layers at spaced locations on the first substrate by growing a respective semiconductor layer on each of the selective growth regions. The first substrate is then divided into a plurality of second smaller substrates that contain only a respective one of the plurality of semiconductor layers. This dividing step is preferably performed by partitioning (e.g., dicing) the first substrate at the spaces between the selective growth regions. The step of forming a plurality of semiconductor layers preferably comprises growing a respective compound semiconductor layer (e.g., gallium nitride layer) on each of the selective growth regions. The growing step may comprise pendeoepitaxially growing a respective gallium nitride layer on each of the selective growth regions. Each of the selective growth regions is also preferably formed as a respective plurality of trenches that have sidewalls which expose compound semiconductor seeds from which epitaxial growth can take place.

36 Claims, 5 Drawing Sheets