United States Patent [19]

Kish et al.

[54] **WAFER BONDING OF LIGHT EMITTING DIODE LAYERS**

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[51] Int. Cl.^{5} H01L 21/20

[52] U.S. Cl. **437/127;** 437/129; 437/130; 437/117

[58] Field of Search 437/127, 129, 130, 905, 437/974, 117, 229; 148/DIG. 135

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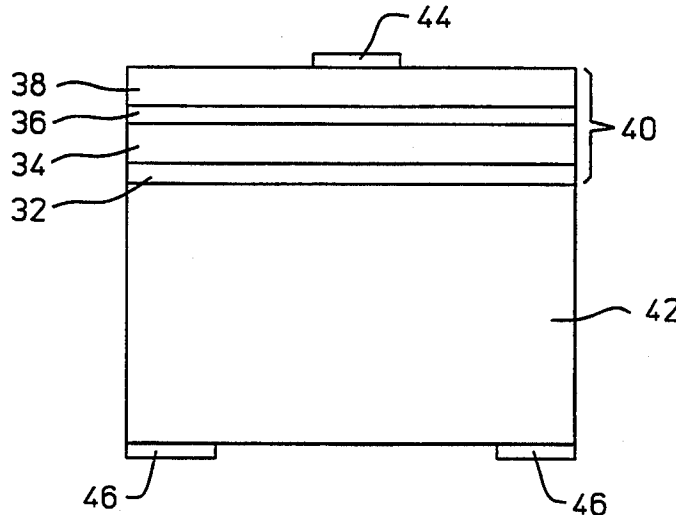
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Assistant Examiner—Kevin M. Picardat

[57] **ABSTRACT**

A method of forming a light emitting diode (LED) includes providing a temporary growth substrate that is selected for compatibility with fabricating LED layers having desired mechanical characteristics. For example, lattice matching is an important consideration. LED layers are then grown on the temporary growth substrate. High crystal quality is thereby achieved, whereafter the temporary growth substrate can be removed. A second substrate is bonded to the LED layers utilizing a wafer bonding technique. The second substrate is selected for optical properties, rather than mechanical properties. Preferably, the second substrate is optically transparent and electrically conductive and the wafer bonding technique is carried out to achieve a low resistance interface between the second substrate and the LED layers. Wafer bonding can also be carried out to provide passivation or light-reflection or to define current flow.
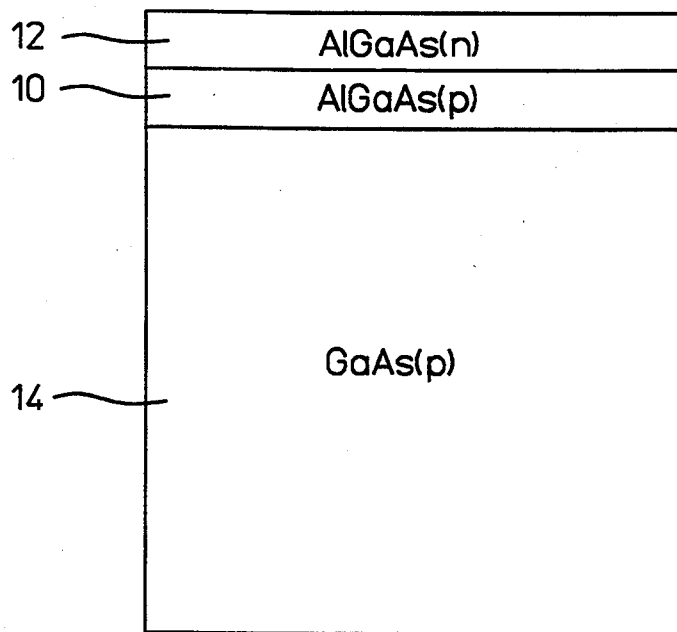
29 Claims, 13 Drawing Sheets

12 — AlGaAs(n)
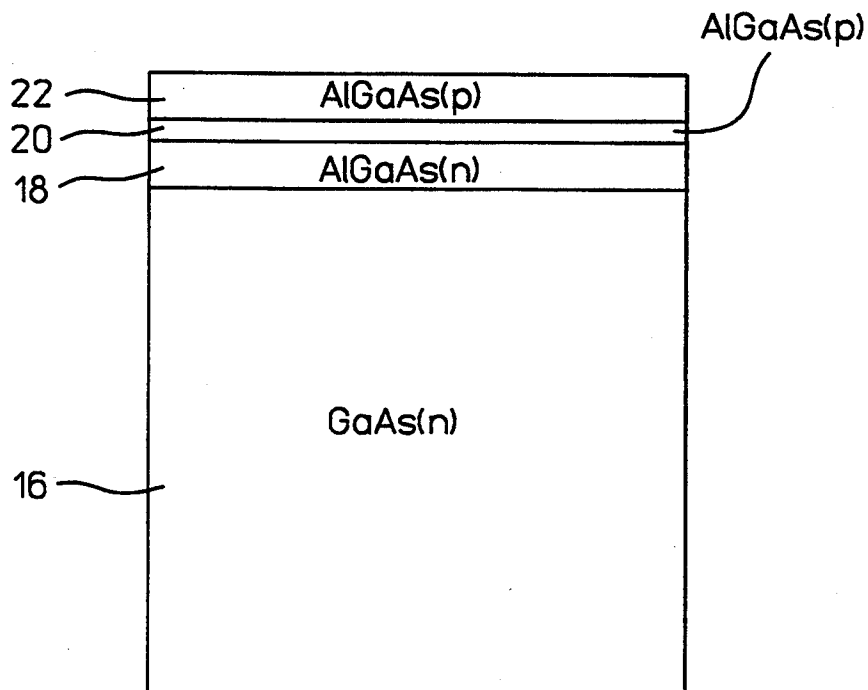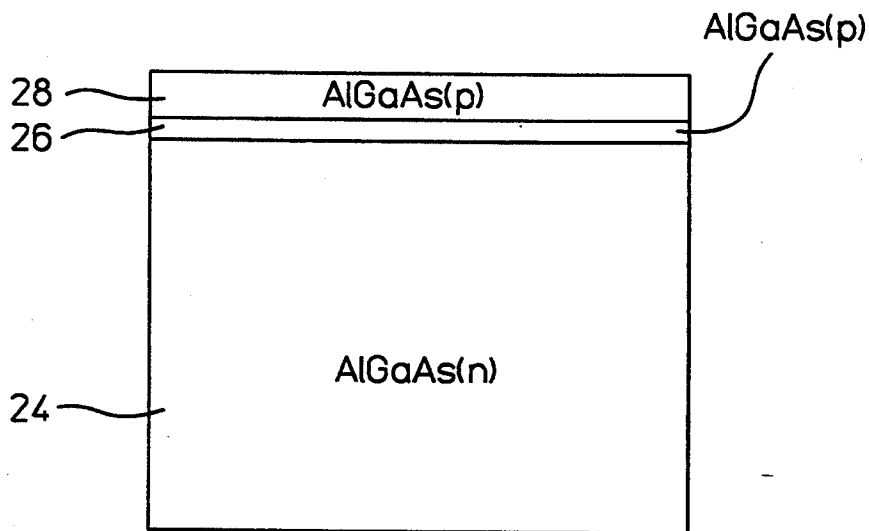
10 — AlGaAs(p)

14 — GaAs(p)

FIG. 1 (PRIOR ART)

AlGaAs(p)

22 — AlGaAs(p)

20 —

18 — AlGaAs(n)

16 — GaAs(n)

FIG. 2 (PRIOR ART)

AlGaAs(p)

28 — AlGaAs(p)

26 —

24 — AlGaAs(n)

FIG. 3 (PRIOR ART)

38 —
36 —
34 —
32 —

30 —
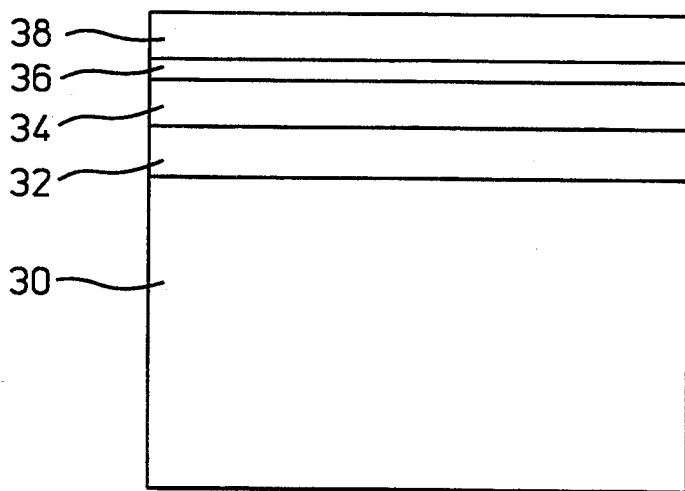
FIG. 4
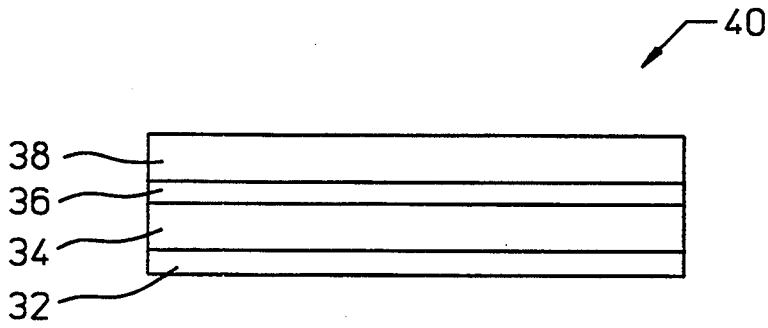
FIG. 5
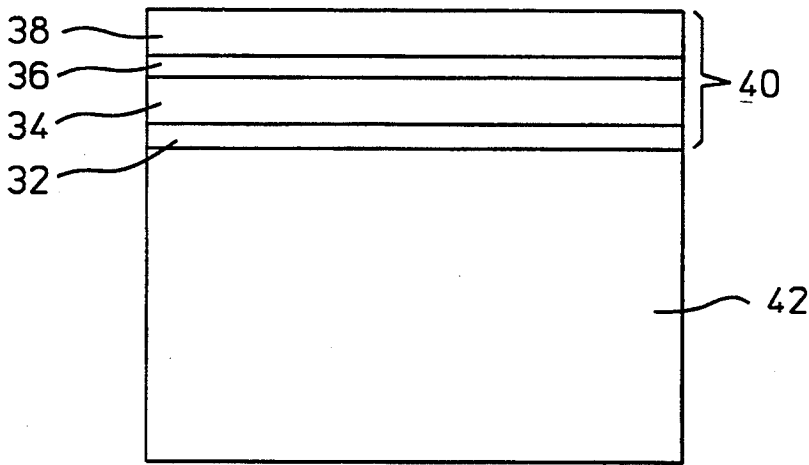
FIG. 6

FIG. 7

FIG. 8

FIG. 9

DOCKET ALARM
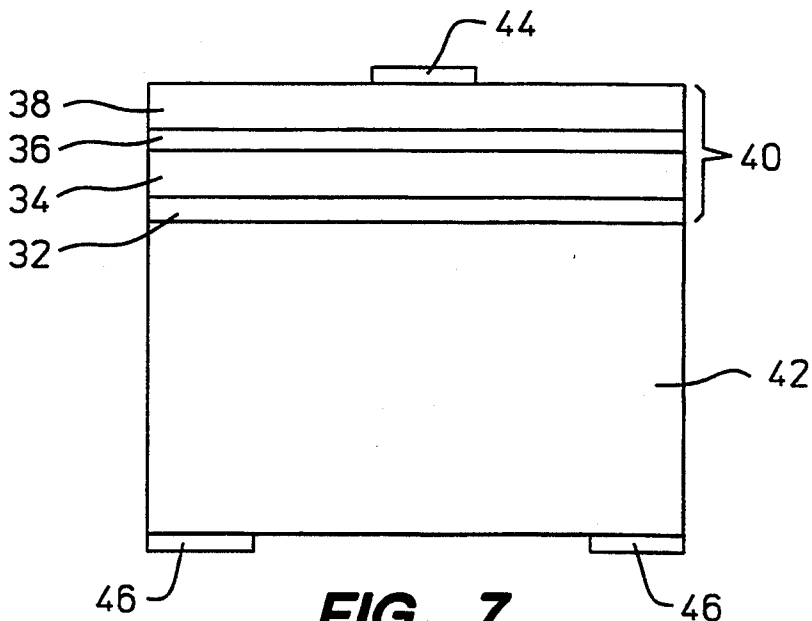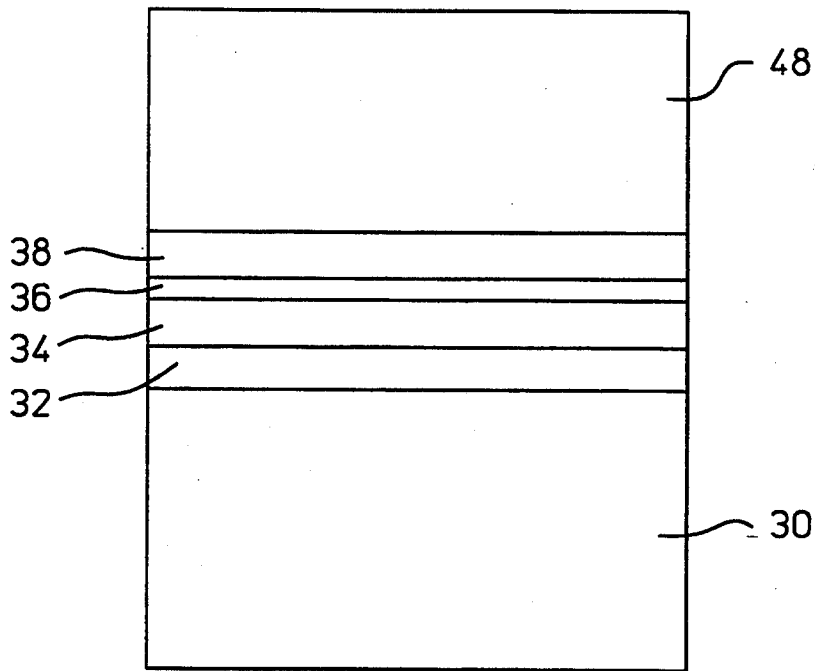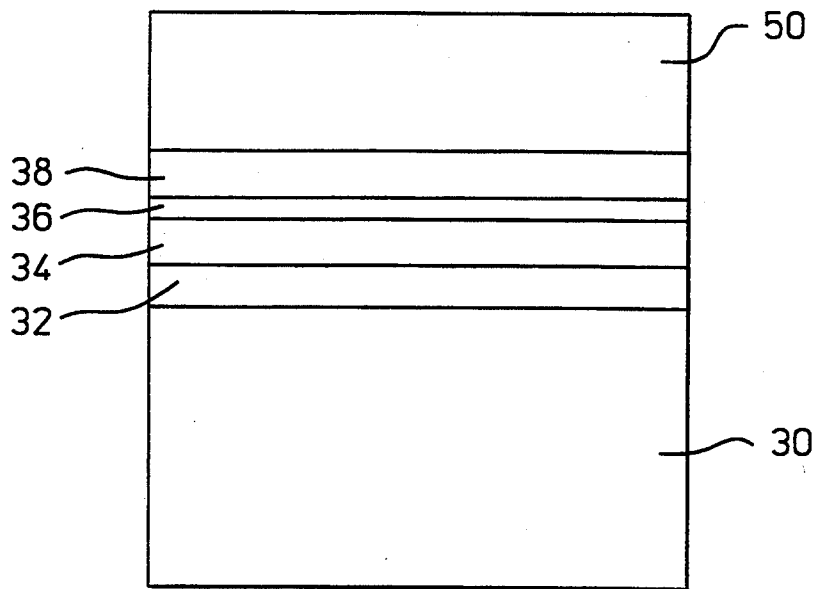
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