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(54) **Title:** SYSTEMS AND METHODS FOR LED STRUCTURES THAT INCREASE CURRENT FLOW DENSITY

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124 p++-transition
122 p+-transition
120 p-transition
118 p-cladding
116 p-spacer
114 active light emitting
112 n-spacer
110 n-cladding
108 n+-contact
106 n-etchstop
104 n-buffer
102 Substrate

Figure 1

(57) **Abstract:** Epitaxial structure for micro light emitting diode (LED), includes a semiconductor substrate (102), an N-type electrical conductive layer (108) on the semiconductor substrate (102), a N-type cladding layer (110) on the N-type electrical conductive layer (108), an oxide layer (210) within the N-type cladding layer (110) or/and between the N-type electrical conductive layer (108) and the N-type cladding layer (110), an active light emitting layer (114) on the cladding layer (110) of the first conductivity type, a P-type cladding layer (118) on the active light emitting layer (114), and a P-type electrical conductive layer (120, 122, 124) on the P-type cladding layer (118). The oxide layer (210, 410) is formed as an oxide ring from an oxide layer precursor $\text{Al}_x\text{Ga}_{1-x}\text{As}$ (x is greater or equal to 0.9 and less than 1) in a subsequent oxidation process. The oxide ring effectively increases the PN junction current density and the formed LED device light emission efficiency. A two-time transfer fabrication process is used to form the LED device.

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