file name: How good is “carrier rebalance5”; last update: 2016-3-30

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Laser | stage | doped QWs  total QWs | variance | size | λ at  p300K | Jth,min@  p 300K | Jth at  Tmax,pulsed | Jth at  Tmax, cw | **NR** Jth at  Tmax, cw |
|  |  | cm-3 |  | µm\*mm | µm | A/cm2 | kA/cm2 | A/cm2 | kA/cm2 |
| 82 | 8 | 2 of 5: 4.3e18 | fast-grow clad | 150\*2.0 | 4.9 | 500 | 1.87@335K | no test |  |
| 83 | 8 | 2of 5: 4.3e18 | no top clad | 150\*1.5  150\*1.9 | 4.8  4.86 | 340  **300** | 2.14@337K  [0.97@335K](mailto:0.97@335K) | 275@237K  **253@237K** | [1.1@280K](mailto:1.1@280K)  [1.0@**282K**](mailto:1.0@282K) |
| 84 | 8 | 2 of 5: 4.3e18 | no top clad  sidewall polish | 150\*1.5  150\*2.1 | 5.1 | 370  387? | [0.90@315K](mailto:0.90@315K)  1.0 @320K | 124@209K  **240@236K** | [0.75@269K](mailto:0.75@269K)  [0.82@275K](mailto:0.82@275K) |
| 87 | 8 | 2 of 5: 4.3e18 | fast-grow clad | 150\*~2 | 5.0 | 600 | [1.70@320K](mailto:1.70@320K) | 315@232K | no NR laser |
| 88 | 8 | 2 of 5: 4.3e18 | thinner GaSb? | 150\*1.2  150\*~2 | 5.0 | 640  560 | 1.05@310K  [1.25@320K](mailto:1.25@320K) | 180@200K  280@230K | [0.42@273K](mailto:0.42@273K) |
| 89 | 8 | 2 of 5: 4.3e18 | thinner GaSb? | 150\*2 | 5.6 | 960 | 0.96@300K | no test |  |
| 93 | 8 | 3 of 6: 4.3e18 | follow above | 150\*~2 | 4.66 | **350** | [1.39@327K](mailto:1.39@327K) | 243@231K | no NR laser |
| 95 | 10 | 3 of 6: 2.3e18 | follow above | 150\*1.2  150\*0.8 | 4.8 | 450 | 1.0@320K  1.4@315K | 48@160K?  113@180K | [0.92@272K](mailto:0.92@272K) |
| 96 | 10 | 3 of 6: 6.3e18 | follow above | 150\*1.2  150\*2.5 | 4.6 | 400  **263** | [1.3@330K](mailto:1.3@330K)  [1.1@340K](mailto:1.1@340K) | 100@190K?  144@214K | bad fab. |
| 97 | 10 | 3 of 6: 5.3e18 | follow above | 150\*1.2 | 4.9 | 600 | [1.1@310K](mailto:1.1@310K) | 150@193K | [0.72@250K](mailto:0.72@250K) |
| 105 | 10 | 3 of 6: 2.3e18 | p 3.6e16 SCL | 150\*1.9 | 5.0 | 540 | [1.6@325K](mailto:1.6@325K) | 125@200K | no NR laser |
| 107 | 10 | 3 of 6: 2.3e18 | p 5.1e15 SCL | 150\*1.6 | 5.0 | 1000 | [1.3@305K](mailto:1.3@305K) | 131@195K | [0.65@249K](mailto:0.65@249K) |
| 123 | 15 | 3 of 5: 1.2e18 | no top clad | 150\*1.5 | 5.3 | 500 | [2.0@310K](mailto:2.0@310K) | 180@190K | [0.66@265K](mailto:0.66@265K) |
| 124 | 15 | 3 of 5: 1.2e18 | no top clad | 150\*1.5 | 5.2 | 500 | [2.2@330K](mailto:2.2@330K) | 160@216K | [0.66@266K](mailto:0.66@266K) |
| 125 | 15 | 3 of 5: 3.3e18 | no top clad | 150\*2.0 | 5.1 | 400 | [1.6@340K](mailto:1.6@340K) | 170@224K | [0.93@273K](mailto:0.93@273K) |
| 126 | 15 | 3 of 5: 5.3e18 | no top clad | 150\*1.5 | 5.0 | 500 | [2.0@335K](mailto:2.0@335K) | 180@219K | no NR laser |
| 136 | 15 | 3 of 5: 3.3e18 | 1um SL | 150\*1.5  150\*2.0 | 5.2 | 340  350 | [1.6@360K](mailto:1.6@360K)  3.0@372K | 150@205K  no test | no NR laser |
| 140 | 15 | 3 of 5: 3.3e18 | 1um SL, no top | 150\*1.5  150\*2.0 | 4.6 | **270**  **247** | [4.9@370K](mailto:4.9@370K)  2.0@370K | 193@230K  no test | [0.64@272K](mailto:0.64@272K) |
| 139 | 18 | 2 of 4: 3.3e18 | 1um SL, no top | 150\*1.5  150\*2.0 | 6.3 | 920  **810** | 3.4@324K  3.3@322K | 120@196K  no test | no NR laser |
| 141 | 18 | 2 of 4: 1.2e18 | 1.1um SL | 150\*1.5 | 6.7 | 1000 | [1.7@310K](mailto:1.7@310K) | 144@206K | no NR laser |
| 147 | 16 | 2 of 4: 3.3e18 | 1.2 SL,0.65 SCL | 100\*2.0 | 6.9 | no lase | [0.8@280K](mailto:0.8@280K) | 220@199K | no NR laser |
| 142 | 12 | 3 of 5: 3.3e18 | 1um SL,-10%Al | 150\*2.0 | 4.75 | 290 | [1.75@359K](mailto:1.75@359K) | 205@241K | [0.97@298K](mailto:0.97@298K) |
| 143 | 12 | 3 of 5: 1.6e18 | 1um SL | 150\*2.0 | 4.5 | 295 | [3.9@376K](mailto:3.9@376K) | 290@242K | [0.75@295K](mailto:0.75@295K) |
| 144 | 10 | 3 of 5: 3.3e18 | 1um SL | 100\*2.0 | 4.7 | 290 | [3.1@377K](mailto:3.1@377K) | 250@249K | [0.89@308K](mailto:0.89@308K) |
| 145 | 10 | 3 of 5: 1.6e18 | 1um SL | 100\*2.0 | 4.6 | 330 | [2.0@360K](mailto:2.0@360K) | 310@242K | [0.95@306K](mailto:0.95@306K) |
|  |  |  |  |  |  |  |  |  |  |
| 1046 | 6 | 5 of 8: ? | 3/2 um SL | 100\*1.6 | 3.2 | 310 | 2.5@360K | 270@248K | [0.95@**306K**](mailto:0.95@306K) |
| 1050 | 6 |  |  | 100\*2  100\*1.5 |  | 268  295 | 2.6@367K  2.8@262K | no test  281@250K |  |
| 1051 | 6 |  |  | 100\*1.5 |  | 350 | 2.2@350K | 247@245K |  |
| 1079 | 6 |  |  | 100\*2 |  | 270 | 2.7@366 |  |  |
| 1080 | 6 |  |  | 100\*2 |  | 260 | 2.05@365 | 150@240K |  |
| 1081 | 6 |  |  | 100\*2 |  | 236 | 1.5@365 | 166@240K |  |
| 1082 | 6 |  |  | 100\*2 |  | 260 | 2.8@367 | 147@240K |  |
| 1083 | 6 |  |  | 100\*2 |  | 291 | 2.55@364 | 170@229K |  |

Note:

“carrier rebalance” strategy was published on 2011-12-13. First wafer grown at OU with this design is R75.

* All previous testing of R48~R108 were over focus on the low temperature, the property at which is dominated by defects and growth variation. The focus should move to **high temperature** at which the performance is more dominated by **intrinsic laser structure**.
* 100um BA mask is available since R123; 10um NR mask is available since R109.
* NRL doped 4 of 6 QWs in the electron injector.
* BNC cable with less resistance was used after 2014-11.

## Suggestion for mounting new laser bars

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| suggested name | suggested length | priority | note, purpose | Update |
| R141BA\_3 | 2mm | 1 | To compare R139 |  |
| R095BA\_3 | 2 mm | 2 | To compare R96 |  |
| R097BA\_3 | 2 mm | To compare R96 |  |
| R124BA\_3 | 2 mm | 3 |  |  |
| R126BA\_3 | 2 mm | to compare R125 |  |
| R094BA\_3 | 2 | 100 | 3 QW study |  |
| R098BA\_3 | 2 |  |
| R099BA\_3 | 2 |  |
| V1050BA\_2 | 2 |  |  |  |
|  |  |  |  |  |

## Suggestion for new fabrication

|  |  |  |  |
| --- | --- | --- | --- |
| suggested name | suggested size | priority | note, purpose |
| R83NR#2\_1 | 10 µm\* 3mm | 1 | may reach cw RT |
| R139NR\_1 | 10 µm\* 2mm | 0 | beach mark for 6 µm NR laser |
| R65/R66 | 100 µm\* 2mm | 2 | really compare the hybrid waveguide |
|  |  |  |  |

## Some ideas for future work

1. R83/88/84 are very similar, the major difference is the thickness of the first InAs QW in active region.   Actually, the ratios of 2 InAs QW in active region in our current laser (e.g. R144) is similar to R088 instead of R083. I think the thickness difference should be larger (e.g. 3~4 A ) to counter the Stark effect.
2. A fast/slow growth rate study of R82/83, R87/88.
3. If R83 is fabricated into 10-um NR devices,  cw 293K or even higher is possible.
4. A detailed study of the number of stages should be also useful.