**Supplementary information**

Table S1: PVparameters performance for champion cells for Tsubstrate 420°C.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time |  | \*020 | \*120 | \*130 | \*211 | \*221 | \*002 | \*301 | \*041 | \*141 | \*061 | ΣTC[hk0] |  | ΣTC[hkl] l≠0 |  | ΣRCT |
| 1 minutes  | TC | 0.0 | 0.1 | 0.5 | 1.2 | 1.6 | 0.5 | 0.9 | 2.4 | 2.1 | 0.7 | 0.6 |  | 9.4 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 0.5 | 0.7 | 1.5 | 1.2 | 0.3 |  |  |  |  | 6.3 |
| 2 minutes  | TC | 0.0 | 0.1 | 0.9 | 1.2 | 1.6 | 0.6 | 1.1 | 2.0 | 1.9 | 0.6 | 0.9 |  | 9.1 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 0.6 | 0.8 | 1.2 | 1.1 | 0.3 |  |  |  |  | 6.1 |
| 4 minutes  | TC | 0.0 | 0.0 | 0.6 | 1.2 | 1.5 | 0.7 | 1.2 | 2.3 | 1.8 | 0.6 | 0.7 |  | 9.3 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 0.9 | 1.1 | 0.7 | 0.8 | 1.4 | 1.1 | 0.3 |  |  |  |  | 6.3 |
| 10 minutes  | TC | 0.0 | 0.0 | 0.9 | 1.6 | 1.9 | 0.9 | 1.3 | 1.8 | 1.3 | 0.5 | 0.9 |  | 9.1 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 1.2 | 1.3 | 0.9 | 0.9 | 1.1 | 0.7 | 0.2 |  |  |  |  | 6.4 |

Table S2: PVparameters performance for champion cells for Tsubstrate 490°C.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time |  | \*020 | \*120 | \*130 | \*211 | \*221 | \*002 | \*301 | \*041 | \*141 | \*061 | ΣTC[hk0] |  | ΣTC[hkl] l≠0 |  | ΣRCT |
| 1 minutes  | TC | 0.0 | 0.0 | 1.1 | 1.5 | 1.5 | 1.1 | 1.2 | 1.7 | 1.3 | 0.7 | 1.1 |  | 8.9 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 1.2 | 1.1 | 1.1 | 0.8 | 1.0 | 0.8 | 0.3 |  |  |  |  | 6.2 |
| 2 minutes  | TC | 0.0 | 0.0 | 0.8 | 1.6 | 1.7 | 0.6 | 1.3 | 1.7 | 1.3 | 0.9 | 0.8 |  | 9.2 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 1.3 | 1.3 | 0.6 | 0.9 | 1.0 | 0.7 | 0.4 |  |  |  |  | 6.2 |
| 4 minutes  | TC | 0.0 | 0.0 | 0.7 | 1.3 | 1.6 | 0.6 | 1.1 | 2.4 | 1.7 | 0.7 | 0.7 |  | 9.3 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 1.0 | 1.1 | 0.6 | 0.8 | 1.4 | 1.0 | 0.3 |  |  |  |  | 6.2 |
| 10 minutes  | TC | 0.0 | 0.0 | 0.7 | 1.3 | 1.7 | 0.5 | 1.5 | 2.2 | 1.6 | 0.6 | 0.7 |  | 9.3 |  |  |
|  | RCT | 0.0 | 0.0 | 0.0 | 1.0 | 1.2 | 0.5 | 1.0 | 1.3 | 0.9 | 0.3 |  |  |  |  | 6.2 |



Figure S1: EDS element mapping a) sample image with present of b) O, c) Sb, d) Se in the film deposited with a growth layer at Tsubstrate 420°C for 4 min,