

## Supplementary material

Table 1. Averaged CIGS solar cell performance of the original devices and junction passivated devices with  $\text{Al}_2\text{O}_3$  by ALD.

| Sample            | Voc(mV) | Jsc(mA/cm <sup>2</sup> ) | FF(%) | Rsh( $\Omega\cdot\text{cm}^2$ ) | Rs( $\Omega\cdot\text{cm}^2$ ) | Eff(%) |
|-------------------|---------|--------------------------|-------|---------------------------------|--------------------------------|--------|
| Original          | 679     | 30.2                     | 69.7  | 774                             | 2.6                            | 14.29  |
| Passivated by ALD | 694     | 30.3                     | 73.2  | 1357                            | 2.7                            | 15.40  |

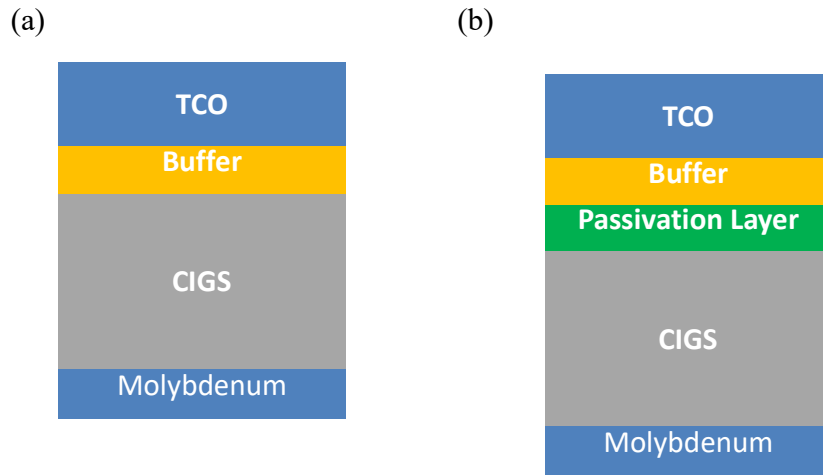


Fig. 1. Device structure of the CIGS solar cell in this study (a) original structure (b) junction passivated structure