

Impact of Buffer Layer Process and Na on Shunt Paths of Monolithic Series-connected CIGSSe Thin Film Solar Cells

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The illuminated current-voltage characteristics of Cu(In,Ga)(S,Se)₂ (CIGSSe) thin film solar cells fabricated using two different buffer layer processes: chemical bath deposition (CBD) and atomic layer deposition (ALD) were investigated. The CIGSSe solar cell with the ALD buffer showed comparable conversion efficiency to the CIGSSe solar cell with CBD buffer but lower shunt resistance even though it showed lower point shunt defect density as measured in electroluminescence. The shunt paths were investigated in detail by capturing the high-resolution dark lock-in thermography images, resolving the shunt resistance contributions of the scribing patterns (P1, P3), and depth profiling of the constituent elements. It was found that the concentration of Na from the soda-lime glass substrate played a key role in controlling the shunt paths. In the ALD process, Na segregated at the surface of CIGSSe and contributed to the increase in the shunt current through P1 and P3, resulting in a reduction in the fill factor of the CIGSSe solar cells.