Interdigitated-back-contacted Silicon Heterojunction Solar Cells Featuring Novel MoOx-based Contact Stacks

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The fabrication process of interdigitated-back-contacted silicon heterojunction (IBC-SHJ) solar cells has been simplified with the development of a tunnel-IBC architecture, which utilizes a highly conductive (p)nc-Si:H blanket layer deposited on a pre-patterned (n)nc-Si:H layer. However, as both electrodes are connected to the same blanket layer, the high lateral conductivity of this layer can lead to low shunt resistance in the device, thus limiting the performance of such solar cells. To overcome such limitation, we introduce a thin (< 2 nm) MoOx layer as a novel alternative to the (p)nc-Si:H blanket layer. The MoOx layer, featuring a low lateral conductivity, can mitigate the shunting issue while allowing a simple fabrication process of the IBC-SHJ solar cells. In the proposed design, holes are transported through the (i)a-Si:H/MoOx contact stack, whereas electrons are collected via a novel contact stack consisting of (i)a-Si:H/(n)nc-Si:H/MoOx. Front/back-contacted (FBC) SHJ solar cells featuring either MoOx for hole collection or (n)nc-Si:H/MoOx for electron collection were fabricated achieving FFs of 79.29% and 82.24%, respectively. The results indicate efficient hole and electron collection through the proposed contact stacks. With this, the first IBC-SHJ solar cell featuring MoOx was fabricated, exhibiting preliminary results with an efficiency of 12.88% and high shunt resistance. Further optimizations of this simplified device processing are being conducted to realize the efficiency potential of our novel IBC-SHJ solar cell architecture.