the NPs, on the ability to form the continuous electrode film, on insulating properties of the SiO_2 shell, on filtering method and other factors. The detailed analysis of the morphology changes caused by inserting NPs, of the effects of density and arrangement of the NPs on the strength of the LSP coupling are currently under investigation and further optimization of the structure is under way.

4. Conclusions

We have presented the Ag/SiO_2 NPs embedded inverted PSC devices. The Ag/SiO_2 NPs were coated on ZnO, on the active layer and mixed into the active layer, respectively. The Ag/SiO_2 NPs strongly contribute to the enhanced absorption in the blue wavelength region, which is conducive to the carrier generation in the active layer. The Ag/SiO_2 NPs embedded device showed the enhanced performance. However, the introduction of NPs can cause certain problems, such as the non-uniform coating of the NPs, the aggregation of the NPs in the active layer, the swelling of the active layer during drop-casting, the interface roughness and breaking down of the continuous electrode film. Consequently, our results indicate that the LSP of Ag/SiO_2 NPs has a beneficial effect on the device performance, but the process should be carefully optimized to obtain the enhanced performance.

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