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Interface engineering of printed wide-bandgap perovskites and chromium-based interconnection layers for multi-junction solar cells

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Introduction

In this poster, we reported the effect of interface engineering of diamine iodide salt with different alkyl chain lengths post-treatments on the morphology and optoelectronic properties of printed wide-bandgap thin films and device performance. In contrast to the long-chain BDADI post-treatment which induced the negative effect of perovskite phase separation, the short-chain PDADI improved the thin film morphology and optoelectronic properties of perovskite layer and significantly suppressed the surface non-radiative recombination. The PDADI modified printed wide-bandgap perovskite solar cells gained the *PCE* of 19.33% with the high V_{OC} of 1.324 eV. On this basis, we used SnO_2/Au/PEDOT:PSS interconnection layer to prepare the perovskite/organic and perovskite/perovskite tandem solar cells (TSCs) with 19.65% and 24.81%, respectively. We then used the cheaper and inert metallic chromium to design the PCBM/Cr/PEDOT:PSS and PCBM/Cr/ITO/PEDOT:PSS interconnection layer structures for the perovskite/organic and perovskite/perovskite TSCs, respectively. Benefiting from good optoelectronic properties of the Cr film, the perovskite/organic and perovskite/perovskite TSCs with the Cr-based interconnection layers achieved comparable PCE (20.22% for the former and 23.24% for the latter) and stability.

Results

Printed Wide-Band-Gap PSCs

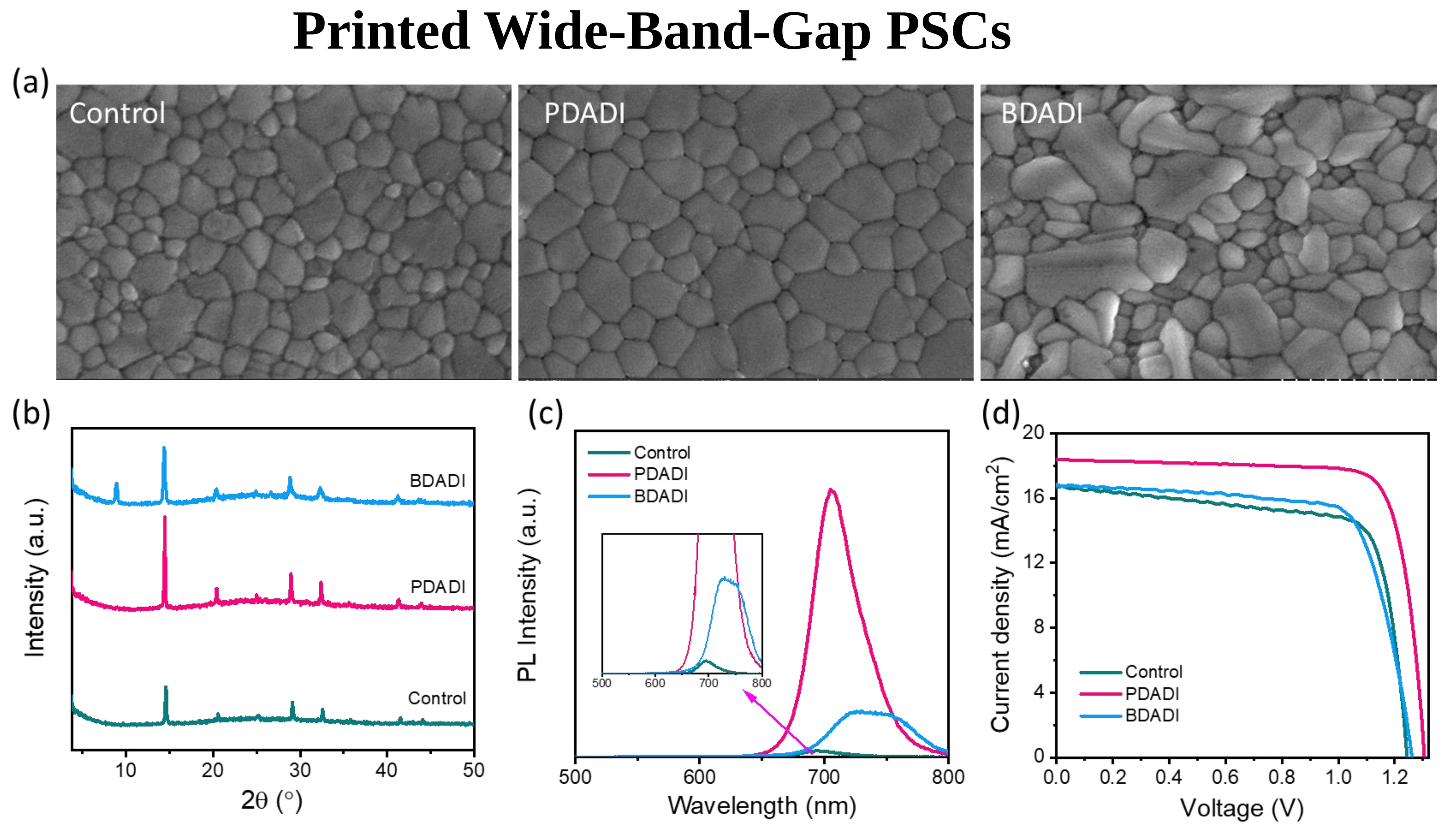

Figure 1. Morphological, structural, optoelectronic characterizations of the printed wide-bandgap-perovskite and device performance.

Carrier Dynamic Behavior of The Wide-Band-Gap PSCs

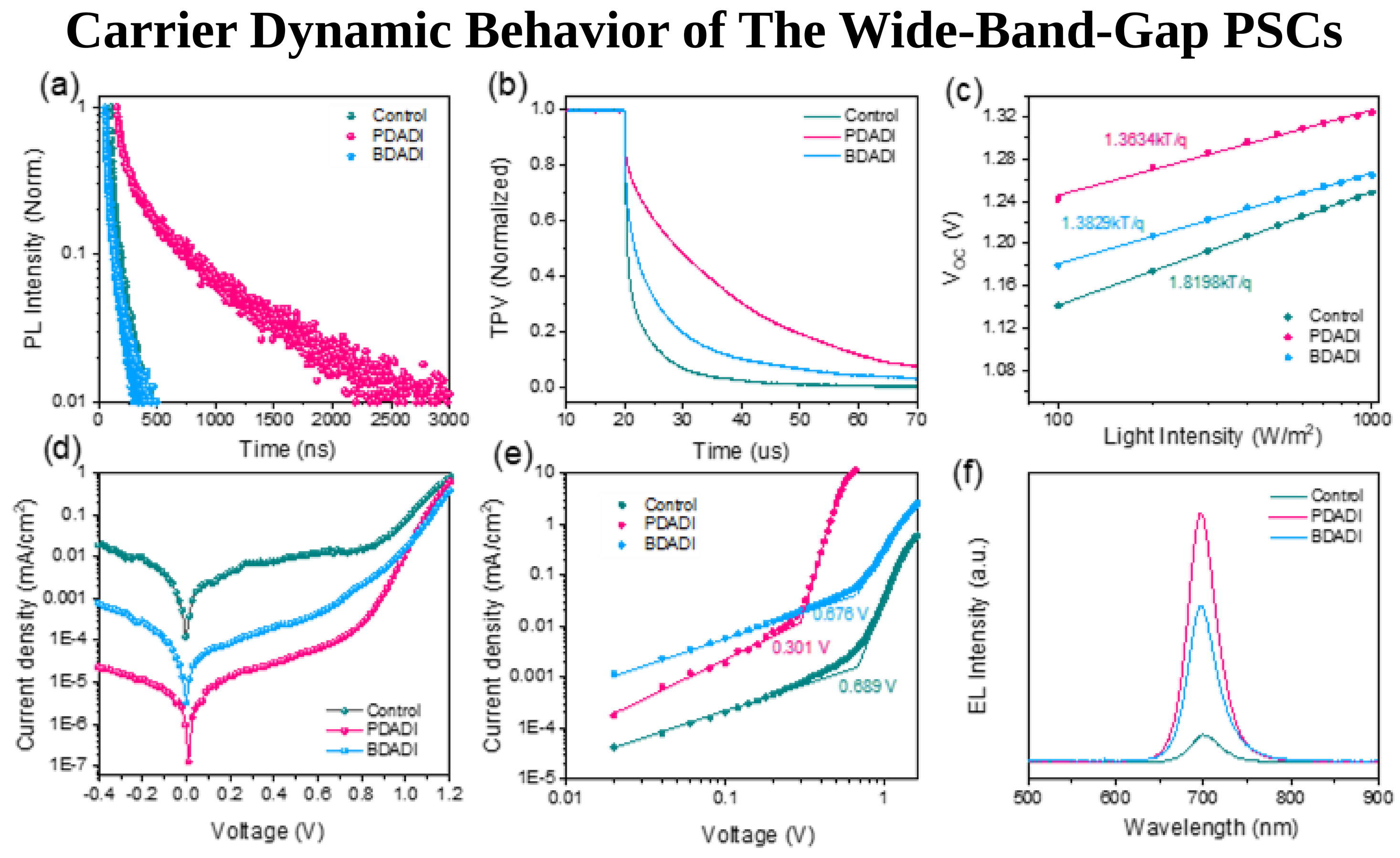

Figure 2. The impact of interface engineering on carrier dynamic behavior in the wide-band-gap PSCs.

Chromium-based Interconnecting Layer

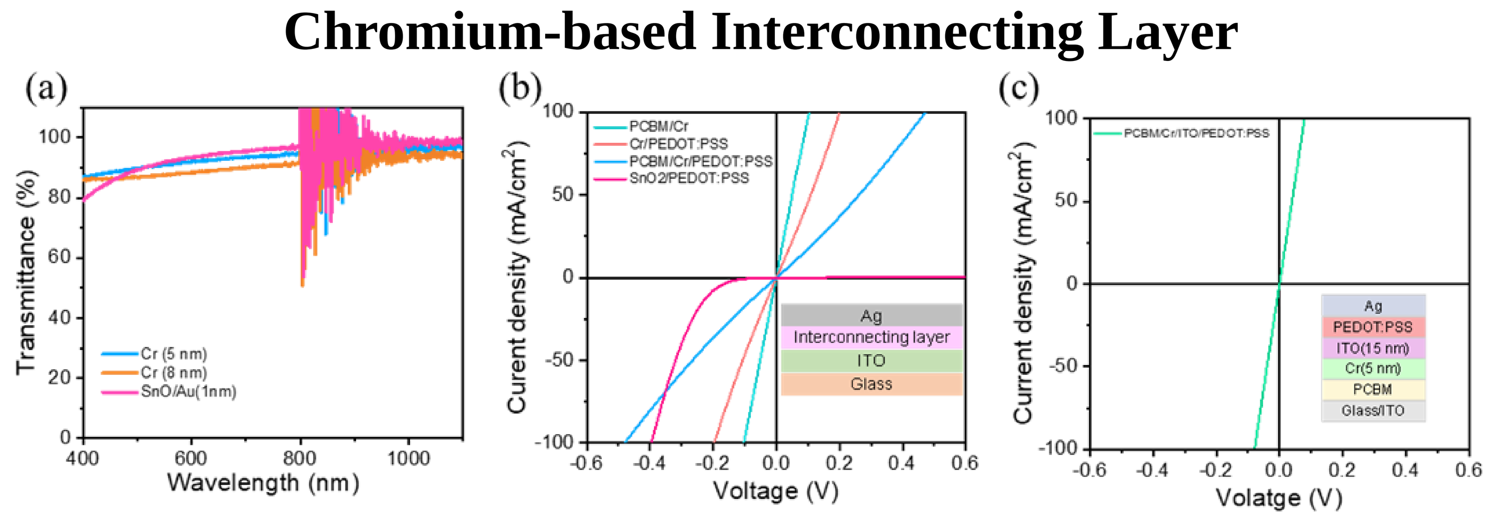

Figure 3. The optoelectronic properties of Cr-based interconnecting layer .

Perovskite/Organic Tandem Solar cells

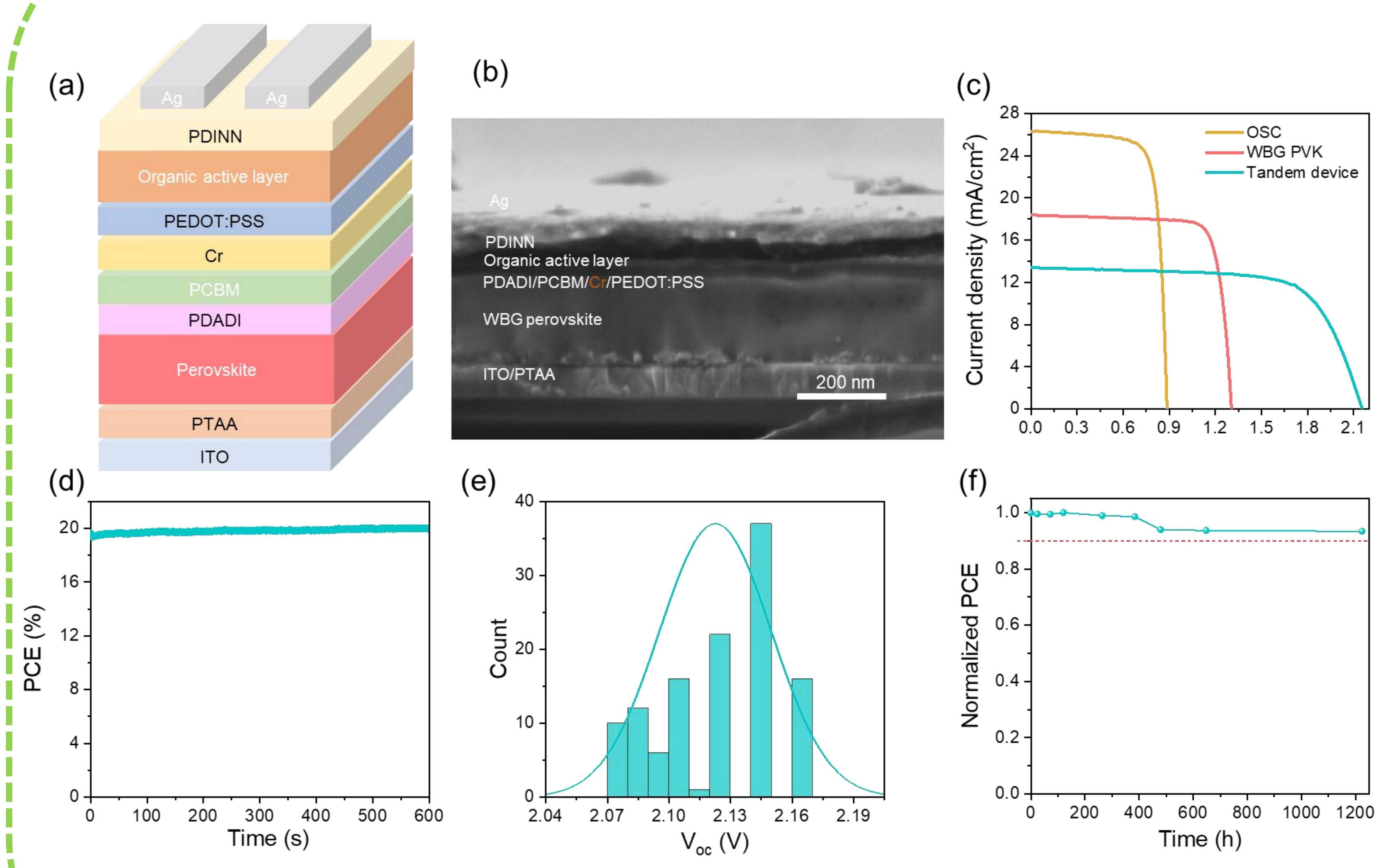

Figure 4. Performance characterization of perovskite/organic tandem solar cells with the Cr-based interconnecting layer.

Perovskite/Perovskite Tandem Solar cells

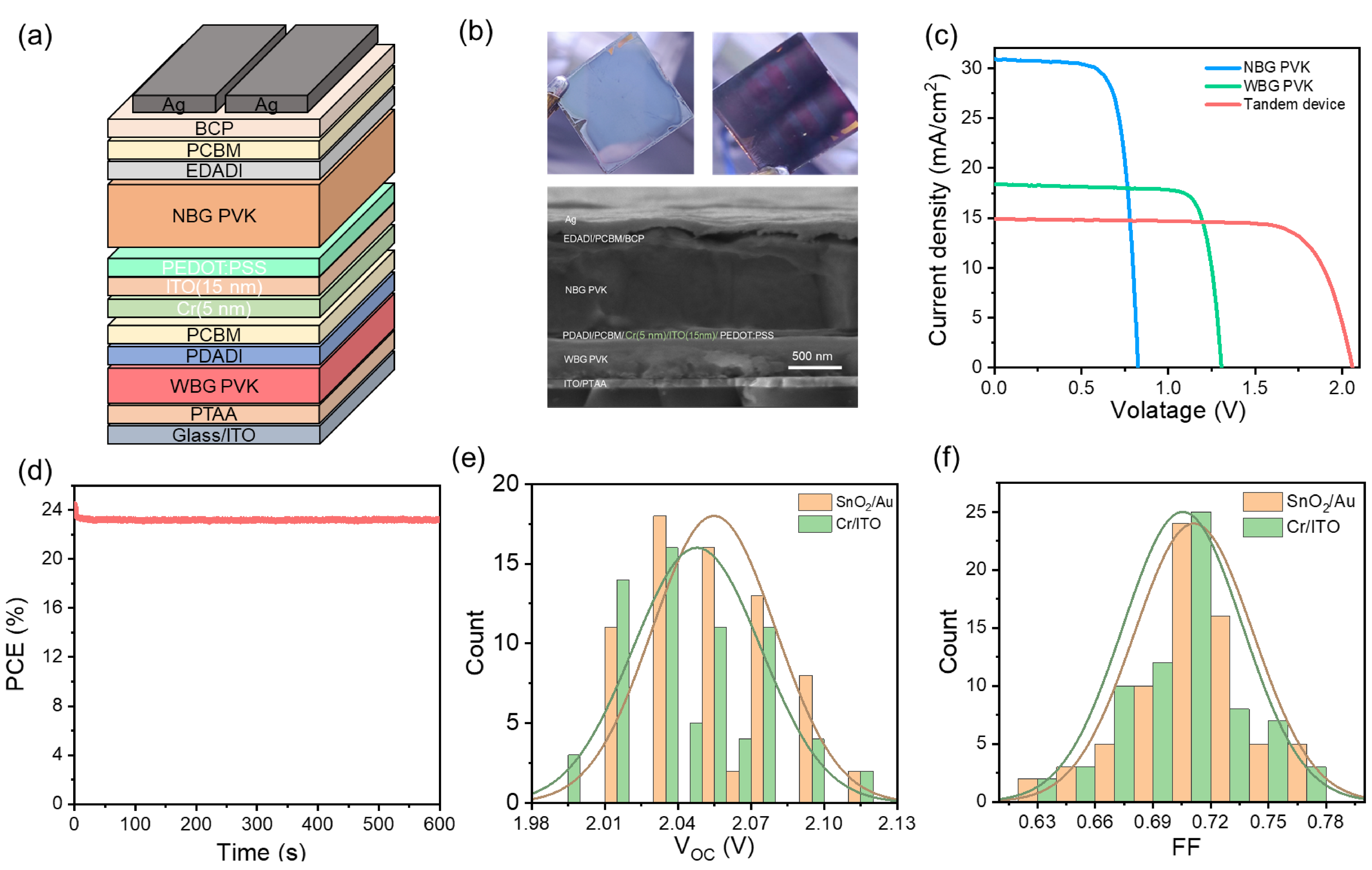

Figure 5. Performance characterization of perovskite/perovskite tandem solar cells with the Cr-based interconnecting layer.

Conclusions

- The PDADI modified printed wide-bandgap perovskite solar cells gained the *PCE* of 19.33% with the high V_{OC} of 1.324 eV.
- Benefiting from good optoelectronic properties of the Cr film, the perovskite/organic and perovskite/perovskite tandem solar cells with the Cr-based interconnection layers achieved the PCE of 20.22% and 23.24%, respectively.

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