**Link:** <https://solar-power-tech.com/e-posters/psc_eposter_15/>

**Abstract**

Despite the outstanding role of the mesoscopic structure on the efficiency and stability of perovskite solar cells (PSCs) in the regular (n–i–p) architecture, mesoscopic PSCs in inverted (p–i–n) architecture have rarely been reported. Although previous research efforts on mesoscopic NiO*x* (mp-NiOx)-based inverted PSCs reveal the critical impact of the morphology of the NiO*x* hole transport layer (HTL) on the charge transfer and interfacial properties in PSCs, the requirement of vacuum-processing and complicated multi-step procedures to fabricate mp-NiO*x* pose a challenge to meet the requirement towards a commercialization of this technology. Herein, we employ an efficient and stable mp-NiO*x* scaffold formed via a simple and low-cost triblock copolymer template-assisted strategy and utilize this mp-NiO*x* film as HTL in the PSCs, for the first time. Promisingly, this approach allows the fabrication of homogenous, crack-free, and robust 150 nm thick mp-NiO*x* films through a facile chemical approach. Such a high quality templated mp-NiO*x* structure promotes the growth of the perovskite film yielding better surface coverage and enlarged grains. These desired structural and morphological features effectively translate into improved charge extraction, accelerated charge transportation, and suppressed trap‎-assisted recombination. As a result, a considerable efficiency of 20.2% is achieved with negligible hysteresis. Notably, the high performance obtained for our mesoscopic devices was achieved without interface passivation or doping strategies and it is among the highest efficiencies for mp-NiO*x*-based inverted PSCs reported to this date. Moreover, it is also important to highlight that the absorber and the charge transport layers were prepared through solution processing, paving the way for a highly efficient, low-cost, and scalable PV technology. Moreover, mesoscopic devices indicate higher long-term stability under ambient conditions compared to planar devices. Overall, the new results obtained in our study set new benchmarks in terms of performance for mesoscopic inverted PSCs employing templated mp-NiO*x* films as highly efficient, stable, and easy fabricated HTLs.