Supporting Information for Melt-Infiltration of Spiro-OMeTAD and Thermal Instability of Solid-State Dye-Sensitized Solar Cells

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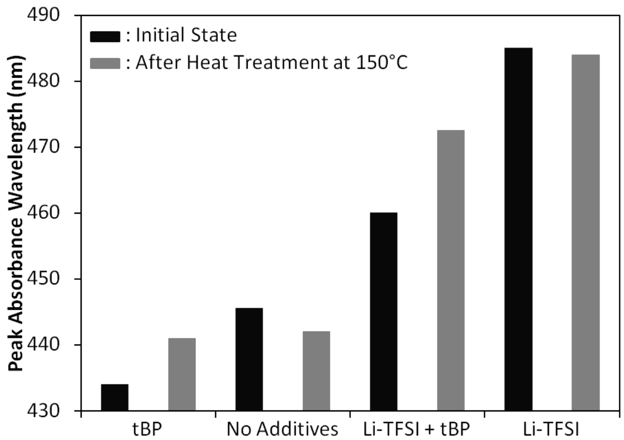

SI Figure 1. Peak wavelength of solid-state absorbance of D35-dyed TiO_2 films with varying additives present in the film introduced during spiro-OMeTAD deposition. Effect of heating the films to 150°C is shown and demonstrates that tBP is evaporating.

SI Table 1. Device performance of D35-sensitized ssDSSCs subjected to melt-infiltration after spiro-OMeTAD deposition. Spiro-OMeTAD deposition solution included standard additives Li-TFSI and tBP.

Condition (Melt-Infiltration After Spiro)	J_{sc} (mA/cm^2)	V_{oc} (V)	Efficiency (%)	FF (-)
No Heat Treatment*	5.78	0.73	2.27	0.54
150°C for 30 min*	2.58	0.42	0.43	0.39
280°C for 30 s*	2.48	0.42	0.35	0.33

*Average of 18 devices

**Average of 6 devices

Capillary Action vs Gravity

Two forces act on the spiro-OMeTAD during the melt-infiltration process to pull the spiro-OMeTAD into the pores from the overlayer while in its viscous state. The gravity vector points towards the TiO_2 in a standard heating configuration and the high surface-area nature of the mesoporous TiO_2 may generate large capillary forces. To differentiate between the two forces and identify the dominant mechanism of the melt-infiltration process, the gravity vector was inverted by turning the heating element upside down on supports and securing the samples to the hot plate by thermal paste and tape. It was found that the PFF improvement by melt-infiltration did not differ by a statistically significant amount from the standard configuration when inverting the gravity vector. By this experiment, gravity was found to play an insignificant role in the melt-infiltration process, identifying capillary forces as the driving mechanism of melt-infiltration.