

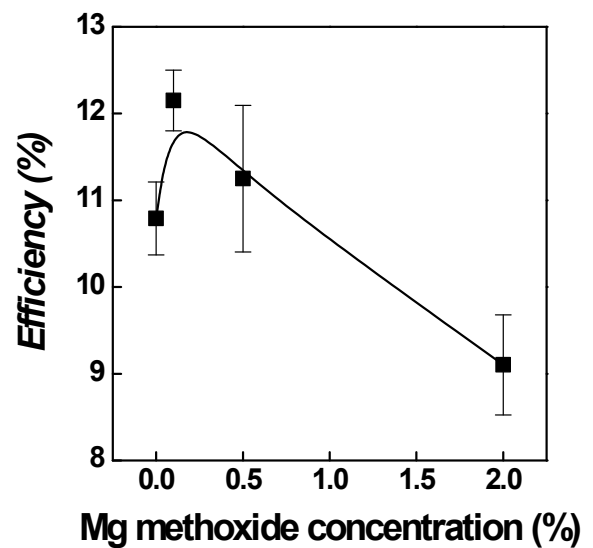
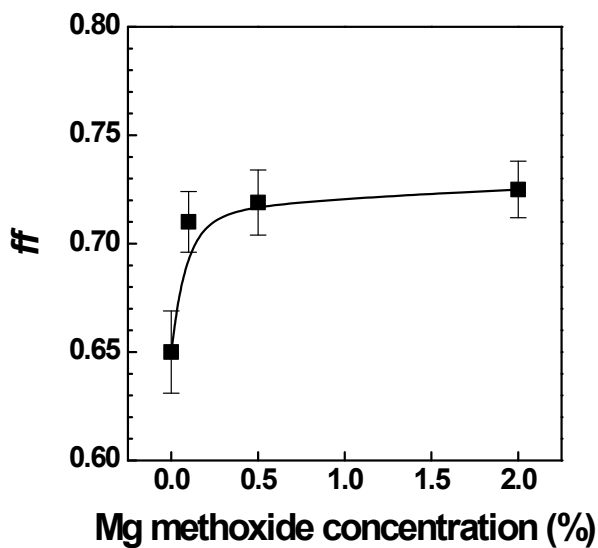
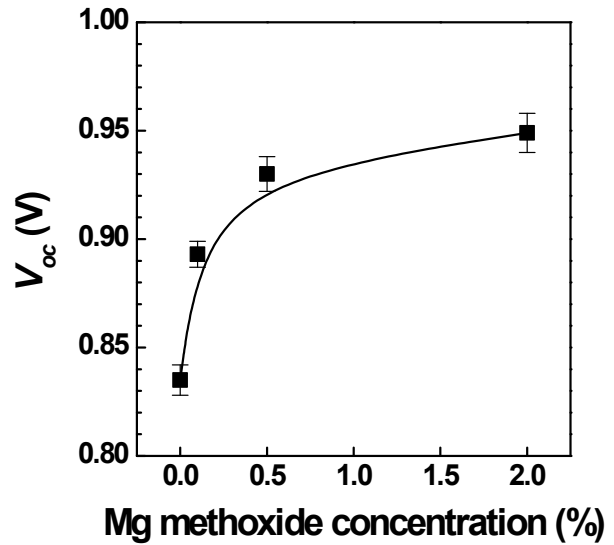
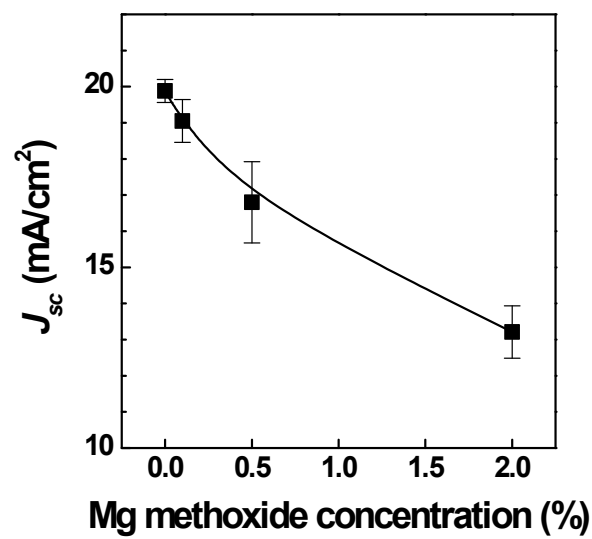
Supplementary Information

Retarding Charge Recombination in Perovskite Solar Cells Using Ultrathin MgO-coated TiO₂ Nanoparticulate Films

By Gill Sang Han, Hyun Suk Chung, Byung Jo Kim, Dong Hoe Kim, Jin Wook Lee, Bhabani Sankar Swain, Khalid Mahmood, Jin Sun Yoo, Nam-Gyu Park, Jung Heon Lee and Hyun Suk Jung

	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	η (%)
Pristine TiO ₂ NPs	19.88±0.32	0.84±0.01	65.0±1.9	10.79±0.42
Mg methoxide Conc. 0.1 wt%/TiO ₂ NPs	19.05±0.60	0.89±0.01	71.4±1.4	12.15±0.35
Mg methoxide Conc. 0.5 wt%/TiO ₂ NPs	16.80±1.13	0.93±0.01	72.0±1.5	11.26±0.85
Mg methoxide Conc. 2.0 wt%/TiO ₂ NPs	13.22±0.72	0.95±0.01	72.5±1.3	9.10±0.58

Supplementary Information 1. *J-V* characteristics of MgO/TiO₂ core shell NP-based perovskite solar cells with varying magnesium methoxide concentration.



Supplementary Information 2. Photovoltaic properties of MgO/TiO₂ core shell NP-based perovskite solar cells with varying magnesium methoxide concentration (a) photocurrent density, (b) open circuit voltage, (c) fill factor, and (d) power conversion efficiency. (Standard deviation was obtained from 10 devices measurement)

Supplementary Information 3. High resolution transmission electron microscopy (HR-TEM) images of MgO-coated TiO₂ nanoparticles as a function of Mg methoxide concentration.

	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	η (%)
Pure TiO ₂	20.11	0.85	67.1	11.4
Mg methoxide Conc. 0.1 wt%/ TiO ₂ NPs	20.02	0.89	71.2	12.7

Supplementary Information 4. *J-V* characteristic of MgO/TiO₂ core shell NP-based perovskite solar cell compared to a TiO₂ NP-based perovskite solar cell, shown in Fig. 5 (a).