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Ga Doping to Significantly Improve Performance of All-electrochemically Fabricated Cu_2O/ZnO Nanowire Solar Cells

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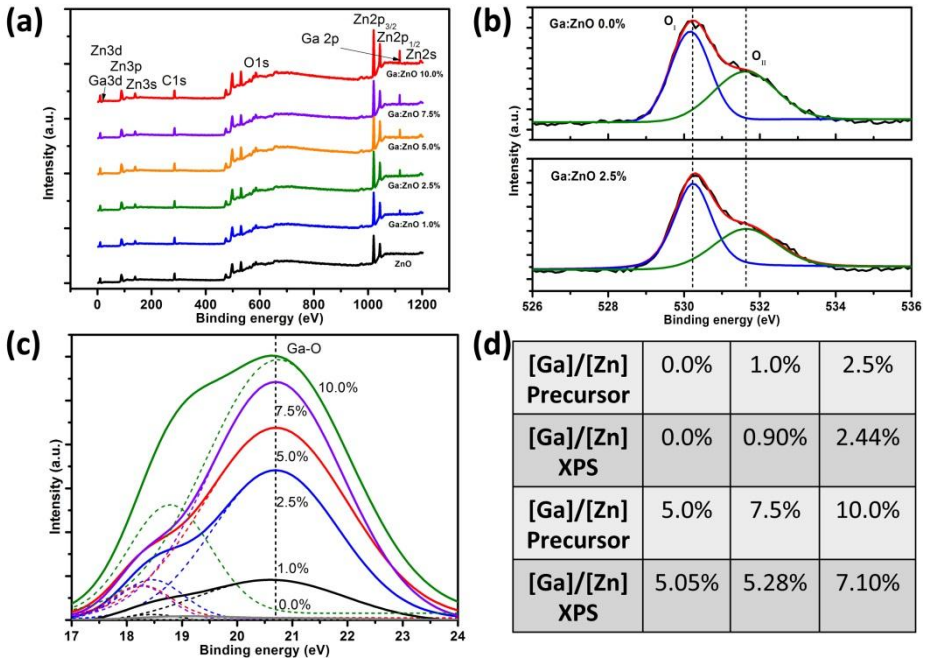

[Ga]/[Zn] Precursor	0.0%	1.0%	2.5%
[Ga]/[Zn] XPS	0.0%	0.90%	2.44%
[Ga]/[Zn] Precursor	5.0%	7.5%	10.0%
[Ga]/[Zn] XPS	5.05%	5.28%	7.10%

Figure S1: XPS spectra of Ga doped ZnO nanowire arrays from the [Ga]/[Zn] precursor solution in the range of 0.0 ~ 10.0% [Ga]/[Zn]. (a) XPS spectra of the Ga doped ZnO NWs as a function of the [Ga]/[Zn] ratio in the precursor solution. (b) XPS scan results for O1s spectra of the undoped and 2.5% Ga doped ZnO NWs. (c) XPS scan results for Ga3d spectra of the undoped and various Ga doped ZnO NWs. The spectra were divided into two curves with Gaussian fitting, which corresponding to Ga-O and Ga3d binding energy curves. (d) The Ga contents in various Ga doped ZnO NWs from the ratios in the precursor solutions and XPS results.

Bias (V)	R1 (kΩ)	Q1/10^{-9} ($\Omega^{-1/\phi 1}$S)	ϕ1	R2 (kΩ)	Q2/10^{-6} ($\Omega^{-1/\phi 2}$S)	ϕ2
Cu_2O/ZnO NWs Solar Cells						
0.05	13.5	4.724	0.86	21.88	3.287	0.55
0.10	13.5	4.118	0.87	15.63	3.795	0.55
0.15	13.0	3.615	0.88	12.19	3.915	0.55
0.20	13.0	5.280	0.85	8.81	5.446	0.53
0.30	13.5	9.733	0.80	4.85	10.471	0.53
Cu_2O/Ga:ZnO NWs Solar Cells						
0.05	18.3	0.493	0.92	44.27	0.600	0.51
0.10	18.6	0.532	0.92	25.97	0.547	0.54
0.15	18.1	0.555	0.91	17.31	0.645	0.54
0.20	18.2	0.582	0.90	11.45	1.335	0.51
0.30	17.8	0.783	0.87	4.696	3.936	0.49

Figure S2: Fitted equivalent circuit parameters for Cu_2O/ZnO NWs solar cells with standard deviations from the fitting routine. The Z-Plot software was used to fit the data.