Supporting Information

Optimized Electrical and Optical Properties of Ag Micro-meshes by Self-generated Crack for Transparent Electrodes

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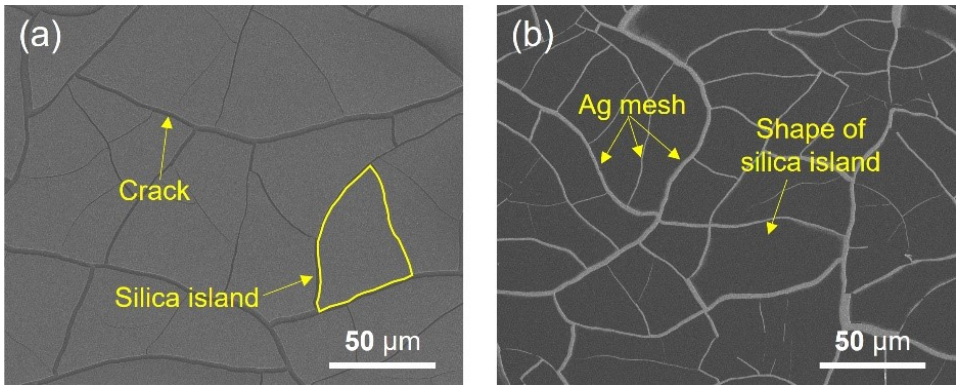

Fig. S1. SEM images of the (a) cracked template after drying the silica solution on the glass substrate and (b) Ag micro-mesh electrode grids after depositing the Ag thin film and lifting off the crack template. Shape of the Ag mesh corresponds to the cracks in the template along with the shape of the removed silica island.

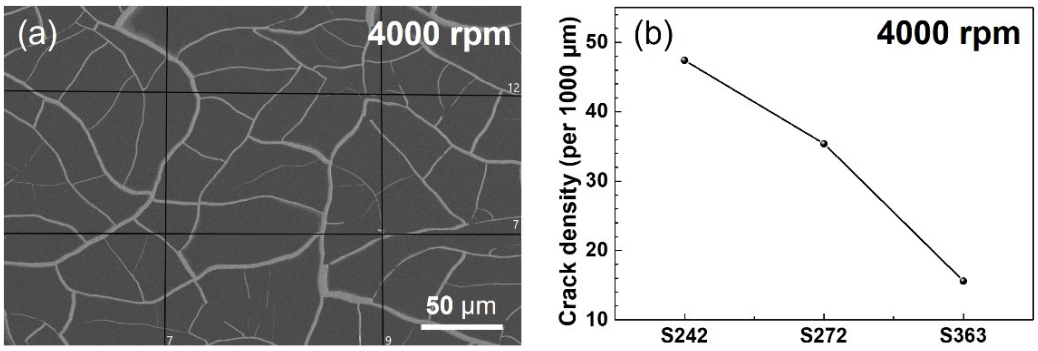

Fig. S2. Figuring calculations of (a) edge density of the metal-mesh structure and (b) crack density as a function of concentration at 4000 rpm.

$$\sqrt{NE} = \frac{1000}{12} \times \left(\frac{12}{628} + \frac{7}{628} + \frac{11}{628} + \frac{9}{628} + \frac{8}{628} + \frac{8}{628} + \frac{7}{442} + \frac{9}{442} + \frac{7}{442} + \frac{7}{442} + \frac{6}{442} + \frac{8}{442}\right) = 15.6$$

where N_E is defined as the number of edges per unit area. For an isotropically distributed edge, $\sqrt{NE}$ denotes the number of edges per unit length. To calculate this parameter, a number of lines (12 lines for each sample) with different image directions was drawn, and the number of edges crossing the line was calculated, as shown in Fig. S2, and normalized to 1 mm (1000 μm).[S1]

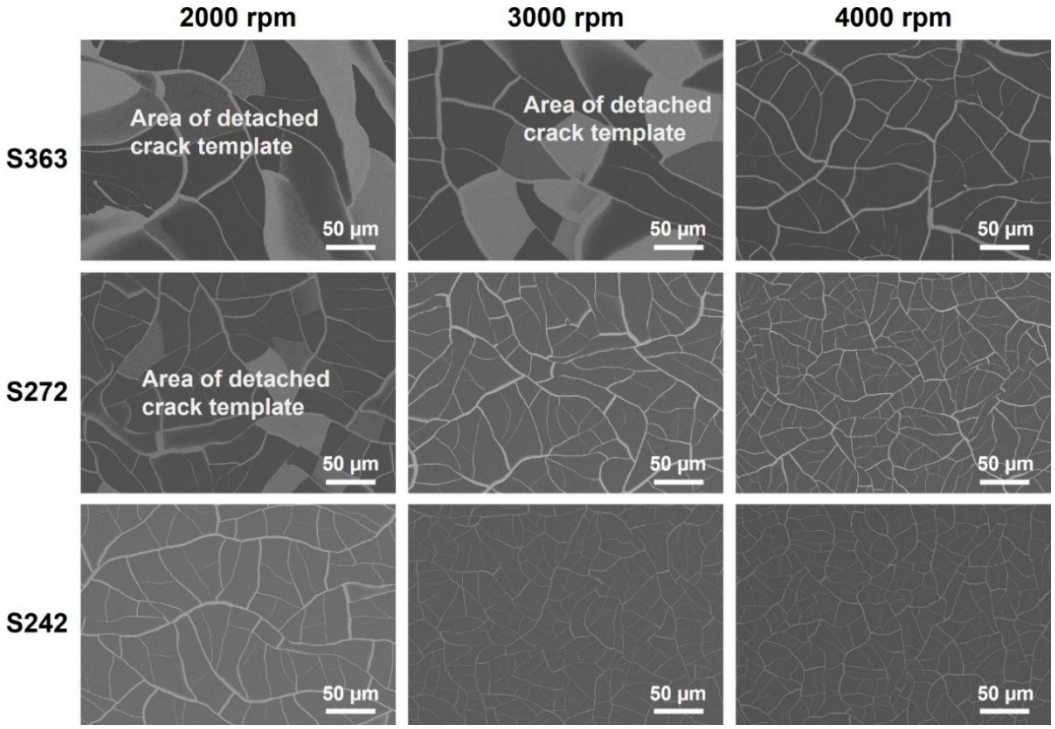

Fig. S3. SEM images of the S242, S272, and S363 samples fabricated at different spin-coating speeds.

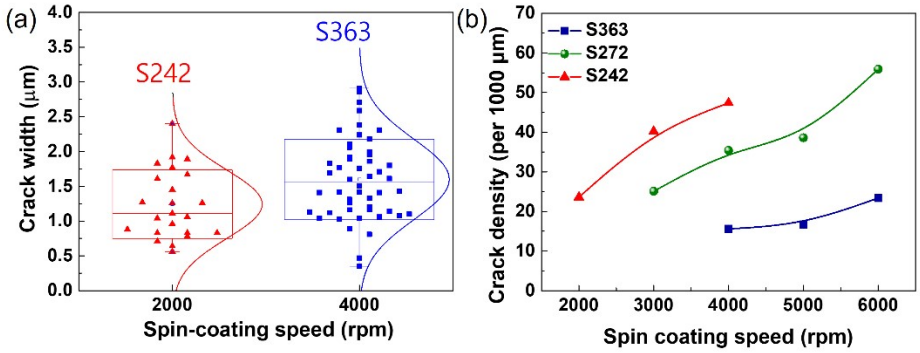

Fig. S4. (a) crack width distribution of S242_2000rpm and S363_4000rpm, (b) crack density of Ag micro-mesh electrodes.

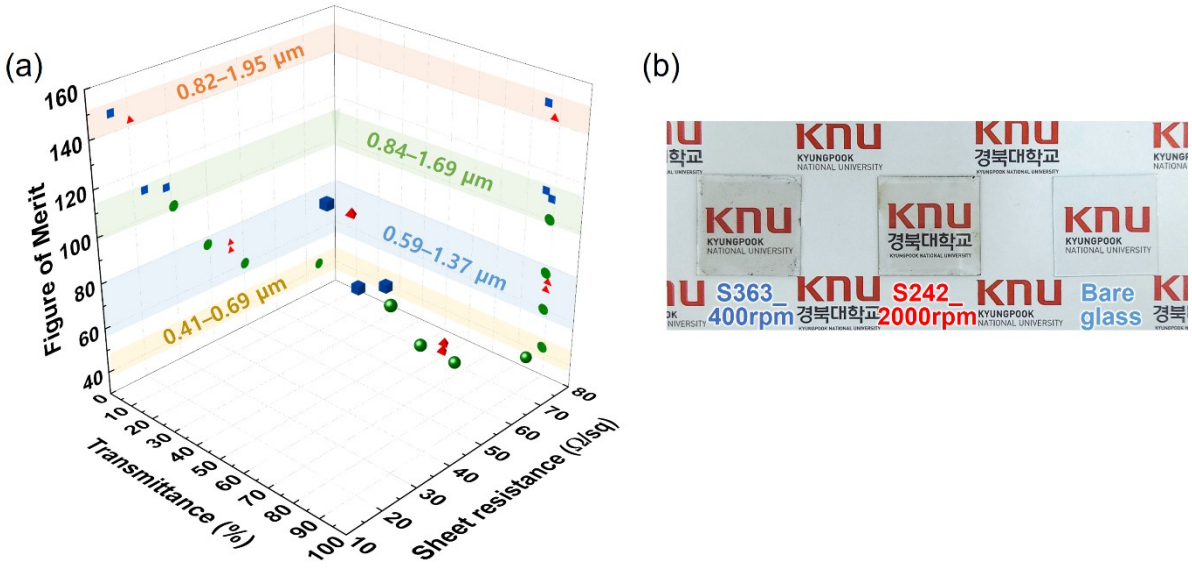

Fig. S5. (a) Figure of merit as a function of transmittance and sheet resistance in three dimentions based on Fig. 6, and (b) photograph images of samples for S363_4000 rpm, S242_2000 rpm, and bare glass substrate.

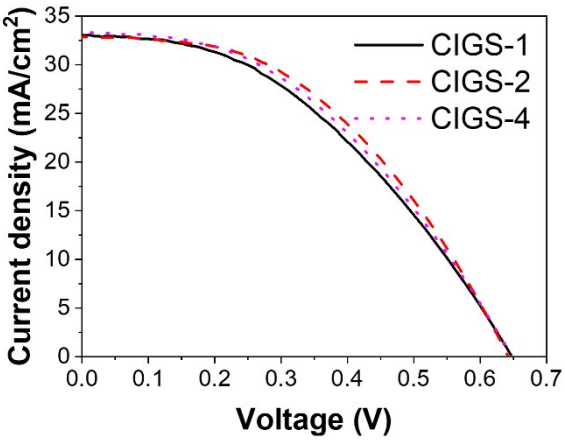

Fig. S6. Current density-voltage (J-V) curves of the CIGS solar cells with Ag micro-mesh electrodes.

Table S1. Properties of CIGS solar cells incorporating Ag micro-mesh electrodes.

	CIGS-1	CIGS-2	CIGS-4
V_{oc} (V)	0.648	0.642	0.648
J_{sc} (mA/cm^2)	33.0	32.8	33.3
FF (%)	42	45	43
Eff (%)	**8.92**	**9.581**	**9.233**

REFERENCE

(S1) A. Kumar and G. U. Kulkarni, Journal of Applied Physics, 2016, **119**, 015102.