

Supporting Information

Table S1. Device performances of the proposed initial OPV with/without WO₃ laser buffer layer and each after the laser process.

	Initial				After laser process			
	V _{oc} (V)	J _{sc} (mA/cm ²)	FF (%)	PCE (%)	V _{oc} (V)	J _{sc} (mA/cm ²)	FF (%)	PCE (%)
Without WO₃	0.81	24.72	60.78	12.17	0.80	11.58	54.09	5.01
	0.81	23.49	62.03	11.80	0.02	3.07	20.44	0.01
	0.80	23.51	60.11	11.31	0.80	11.68	56.49	5.28
	0.79	24.02	59.20	11.23	0.78	11.90	51.73	4.80
	0.80	24.23	62.59	12.13	0.19	10.04	27.76	0.53
	0.81	23.26	62.37	11.75	0.78	10.64	52.72	4.38
	0.80	23.73	60.89	11.56	0.80	11.27	53.36	4.81
	0.81	24.24	58.08	11.41	0.17	9.42	26.91	0.43
	0.80	23.81	60.78	11.58	0.77	11.29	49.08	4.26
	0.79	24.28	58.74	11.27	0.13	8.40	24.10	0.26
	0.80	24.00	57.81	11.10	0.03	4.00	16.99	0.02
	0.81	23.29	63.95	12.07	0.02	3.25	24.71	0.02
With WO₃	0.81	23.29	64.73	12.21	0.80	11.33	57.25	5.19
	0.81	23.83	61.65	11.90	0.63	11.16	31.84	2.24
	0.81	24.61	61.31	12.22	0.80	11.92	58.65	5.59
	0.82	24.28	64.51	12.84	0.79	11.92	55.49	5.22
	0.80	23.80	61.73	11.75	0.80	11.86	58.30	5.53
	0.81	24.08	60.50	11.80	0.03	5.16	22.26	0.03
	0.81	23.54	63.79	12.16	0.80	12.33	53.67	5.30
	0.80	23.90	62.39	11.93	0.80	12.68	58.04	5.89
	0.80	23.63	61.67	11.66	0.80	11.58	53.63	4.97
	0.80	23.62	60.80	11.49	0.79	11.99	56.01	5.30
	0.80	24.14	62.33	12.04	0.78	11.89	52.33	4.85
	0.81	22.68	61.60	11.32	0.78	10.73	54.35	4.55

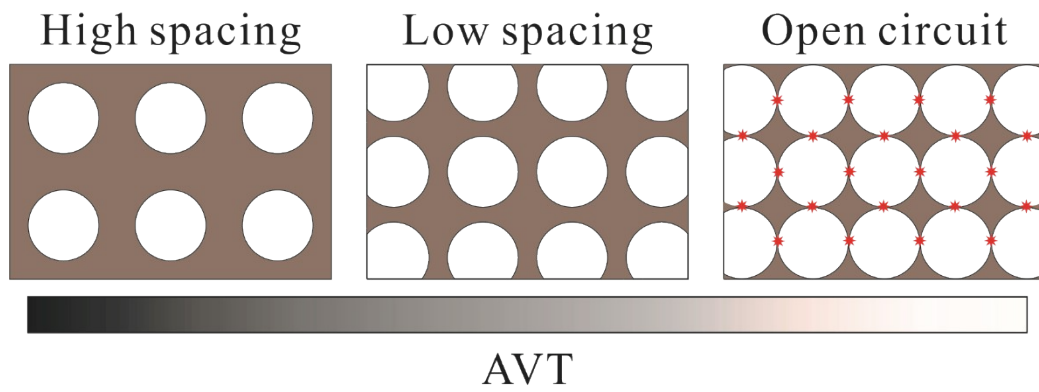


Figure S1. Schematic structure of the circular pattern with varying spacing

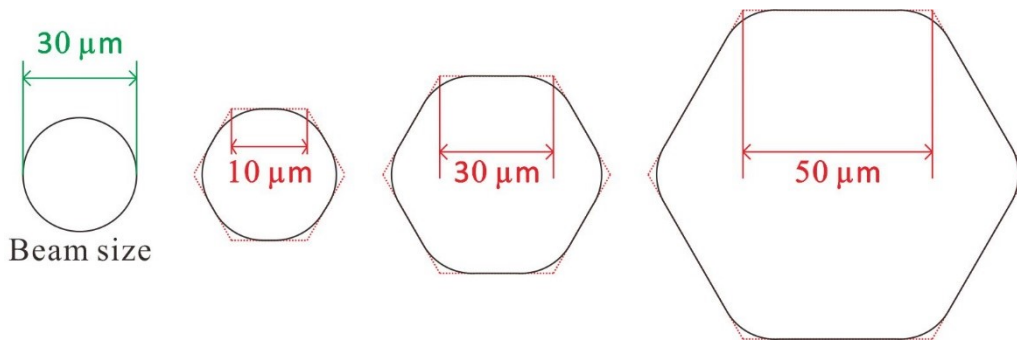


Figure S2. Schematic structure illustrating the limits of laser beam size and hexagon width

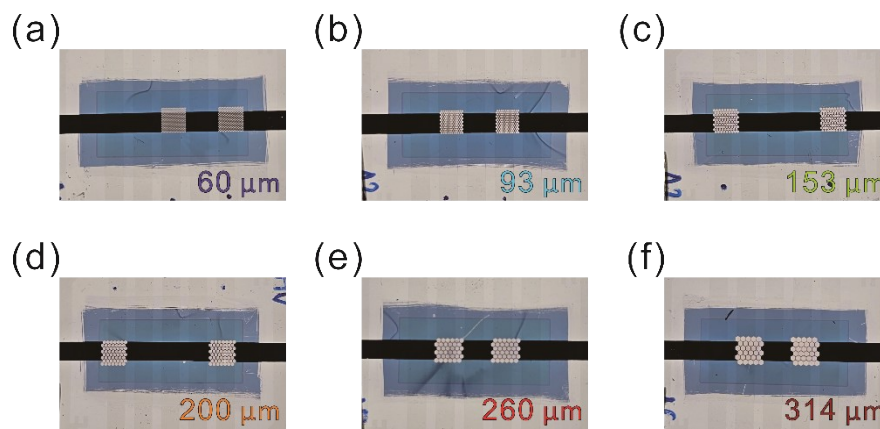


Figure S3. Comparative physical photographs of TPVs exhibiting varying hexagon widths.