**Estimation of parameters for solar cells with S–shaped current–voltage characteristics using meta–heuristic algorithms**

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| Fig.S1. Fitting results (lines) for the simulated current-voltage characteristic (symbols). The values *I*01= 1.6⋅10-6 mA, *n*1= 1.92, *R*p1 = 190 Ω, *I*02 = 0.16 mA, *n*2= 1.92, *R*p2 =190 Ω, *R*s = 45 Ω, *I*ph = 8 mA were assumed under simulation. | | |

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| Fig.S2. Fitting results (lines) for the simulated current-voltage characteristic (symbols). The parameters values from Sec.2.2.2 were assumed under simulation. | | |

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| Fig.S2.  Dependences of the precision of the series resistance (a)–(c), SBH (d)–(f), and ideality factor (g)–(i) determination by different methods on the synthesis temperature. The set of ideal sy  Fitting results (lines) for the simulated current-voltage characteristic (symbols). The parameters values from Sec.2.2.2 were assumed under simulation. | | |