Electronic Supplementary Information

Well-Controlled Synthesis of Wurtzite-Type Cu$_2$ZnSnS$_4$ Nanoparticles Using Multiple Sulfur Sources via a Two-Step Heating Process

Hiroyasu Nishi,*$^a$ Takahito Nagano,$^a$ Tatsuya Kameyama,$^a$ Susumu Kuwabata,$^b$ and Tsukasa Torimoto*$_a$

$^a$ Department of Crystalline Materials Science, Graduate School of Engineering, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan.

$^b$ Department of Applied Chemistry, Graduate School of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka 565-0871, Japan.
Fig. S1 A TEM image of nanoparticles obtained by heating the metal acetates in DDT at 240 °C for 60 min.
Fig. S2 TEM image (a) and XRD pattern (b) of nanoparticles obtained by addition of S and DBTU (50 : 50) into the precursor solution at 200 °C for 180 min. Reference pattern of djurleite (PDF card: #00-034-0660) and simulated pattern of wurtzite-type Cu$_2$ZnSnS$_4$ shown in ref. 17 are also shown. The chemical composition of the particles was determined to be Cu : Zn : Sn = 0.79 : 0.10 : 0.11.
Fig. S3  TEM image (a) and XRD pattern (b) of Cu$_2$ZnSnS$_4$ nanoparticles prepared through the nucleation at 150 ºC for 30 min followed by the crystal growth process at 240 ºC for 30 min.
**Fig. S4** TEM images of nanoparticles obtained after the crystal growth process for 0 (a), 15 (b), 60 (c), and 180 min (d). The panel a is the same as Fig. 1a.