**Figure S1.** Discharging curve of the self-assembled battery used for electrochemical Li intercalation process, discharging by 0.3 mA electric current.

**Figure S2.** a), b) Photograph and SEM micrograph of pristine micro-scaled Bi$_2$Se$_{0.3}$Te$_{2.7}$ powder; c), d) Photograph and SEM micrograph of Li$_{0.89}$Bi$_2$Se$_{0.3}$Te$_{2.7}$ powder after Li intercalation (1 mA, Li amount: 30 mAh/g); e) The colloidal suspensions of as-produced Bi$_2$Se$_{0.3}$Te$_{2.7}$ nano-particles with different densities.
Figure S3. a) XRD patterns of Li$_{0.89}$Bi$_2$Se$_{0.3}$Te$_{2.7}$ powders with the same Li intercalating amount of Q/m=30mAh/g using different magnitudes of discharging currents. b) XRD patterns of Li$_y$Bi$_2$Se$_{0.3}$Te$_{2.7}$ powders with different Li intercalating amounts using the same discharging current of 0.3mA. c) XRD patterns of water exposed products.