

Fig. S1 The temperature dependence of the electrical resistivity when sandwiching 0.50 mM (Cu (I): Cu (II) = 1: 1) electrolyte with FTO substrates. The I-V curve (a) and the electrical resistances obtained from the I-V slope (b). IR of electrolyte after heating at 80 °C for 3 h in Ar atmosphere (c, left) and the IR of PEG at room temperature (c, right).

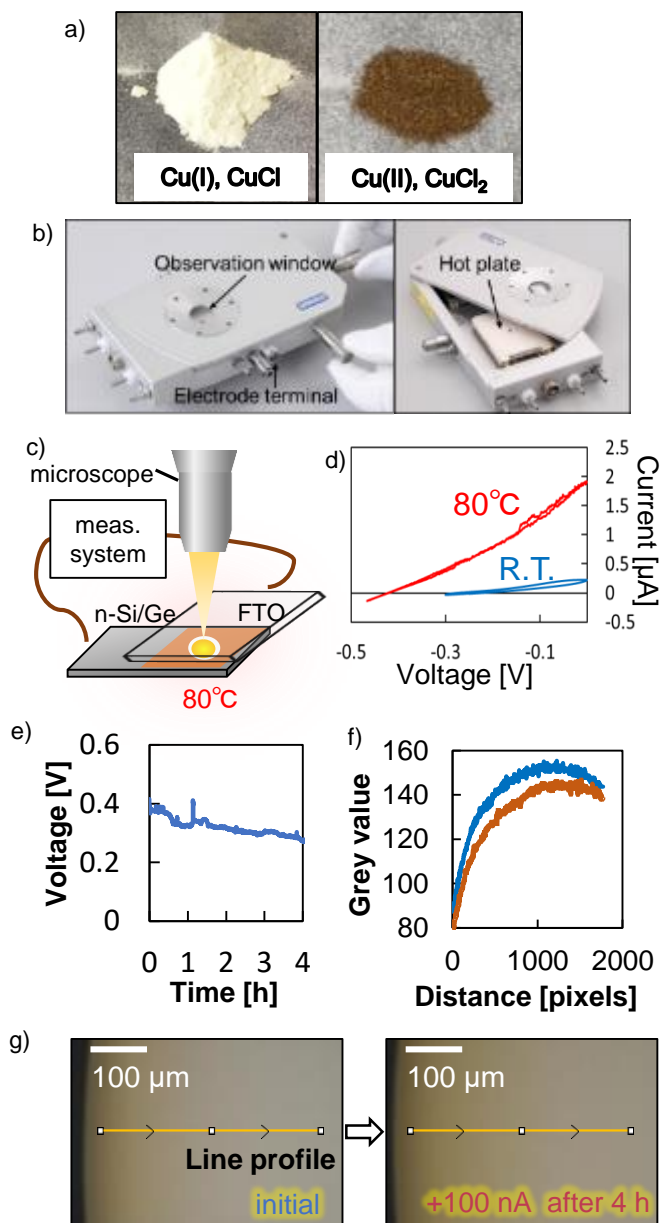


Fig. S2 A.1 Colors of Cu(I) (CuCl) and Cu(II) (CuCl₂) (a), cooling and heating stage for in-situ electrochemical observation (b), schematic image of the in-situ observation (c). I-V curves at room temperature (blue) and 80 °C (red, d), the 100 nA discharge curve at 80 °C (e) of n-Si/Ge|Cu 2 mmol/g, Cu(I) : Cu(II) = 4 : 1|FTO. Line profiles of luminance in two (f) images (g). Blue: initial, red: after 100 nA discharging for 4h. The digital camera images of the electrolyte before and after 100 nA discharging at and 80 °C (g).

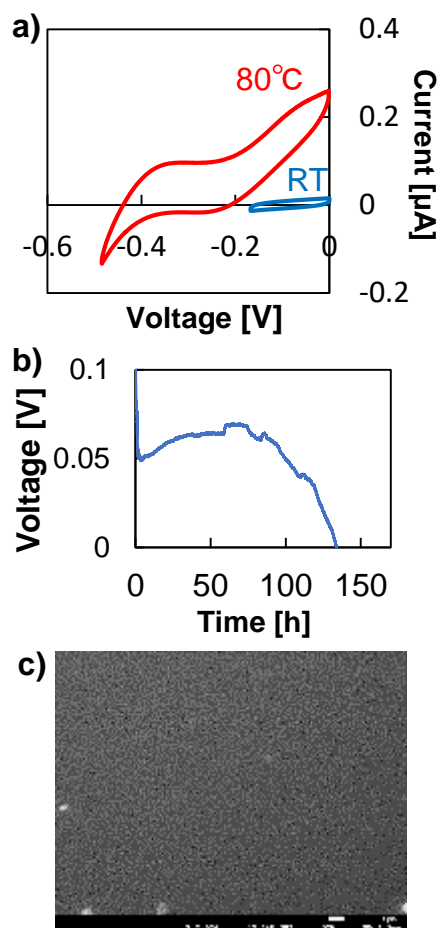


Fig. S3 First I-V curves at 80°C and R.T.(a), and the first discharging curve at 100 nA (b) of n-Si/Ge|Cu 0.2 mmol/g, Cu(I) : Cu(II) = 1 : 1|FTO . The SEM image after the measurement (c) is also shown.

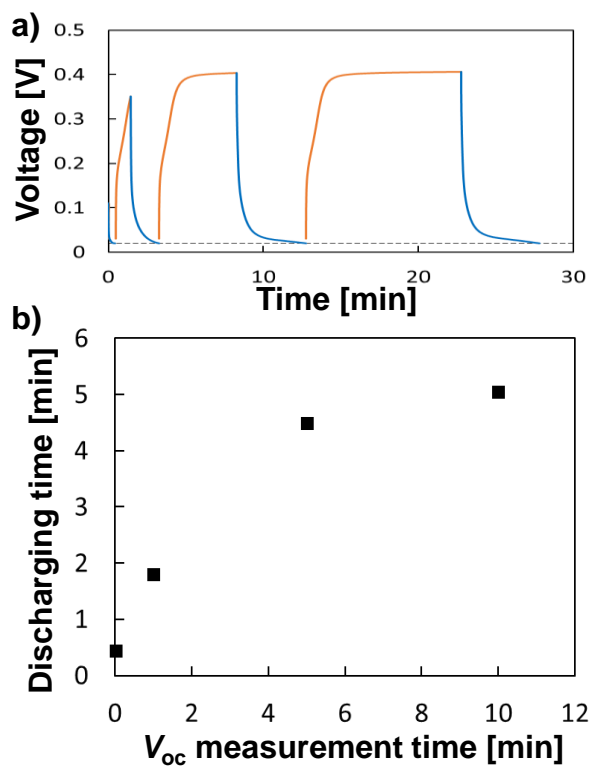


Fig. S4 Repetitive measurement of 100 nA discharging and V_{OC} measurement of n-Si/Ge|0.5 mmol/g, 1 : 1|FTO (a) and the relationship of V_{OC} measurement time and 100 nA discharging time (b).

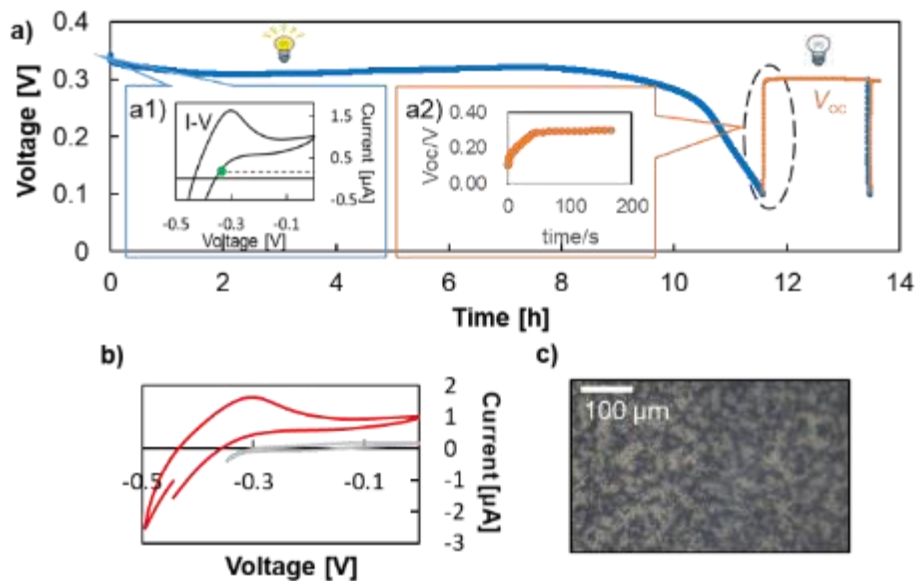


Fig. S5 Discharge (100 nA, blue) and recovery (open circuit voltage, orange) curves when using 2.0 mmol/g electrolyte (a). I-V curve before long-term measurement (a1). Time dependence of open circuit voltage immediately after start of open circuit voltage measurement (a2). The I-V curves before (red) and after (gray) long-term measurement (b). Scan rate: 10 mV/sec.

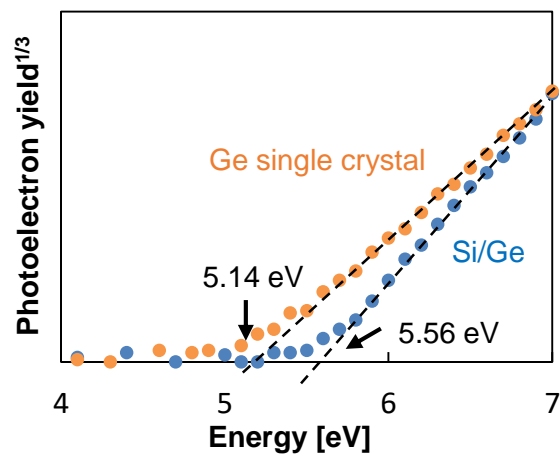


Fig. S6 Work functions of Ge single crystal and Si/Ge wafer.



Fig. S7 Liquid-display test movie by 12 batteries in series. The hot plate temperature was 80 °C. and the cell temperature was about 60 °C.