Supporting Information

A Rechargeable Al-Te Battery

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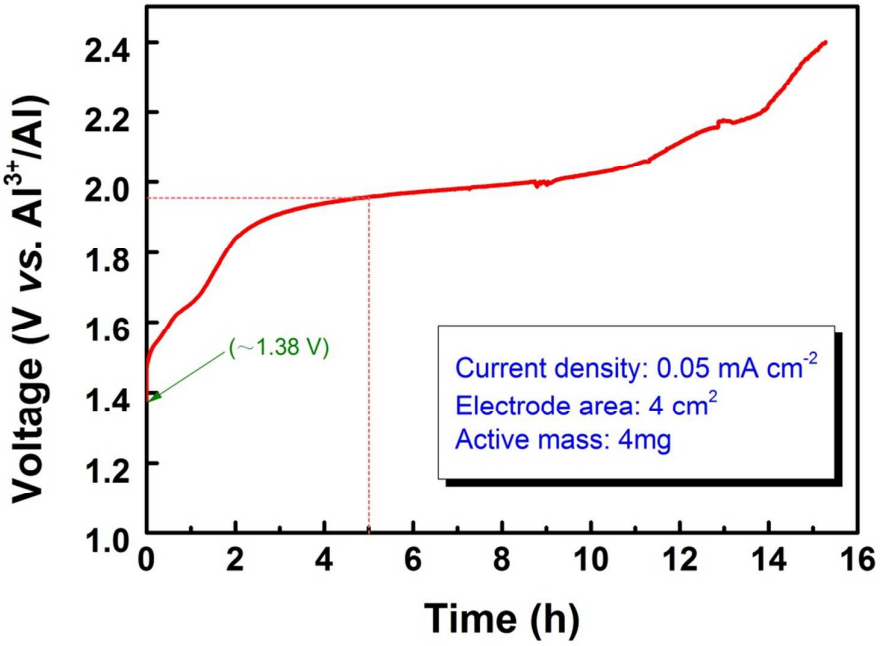

Figure S1: Voltage-time plot of galvanostatic electrolysis at a current density of 0.05 mA/cm^2.

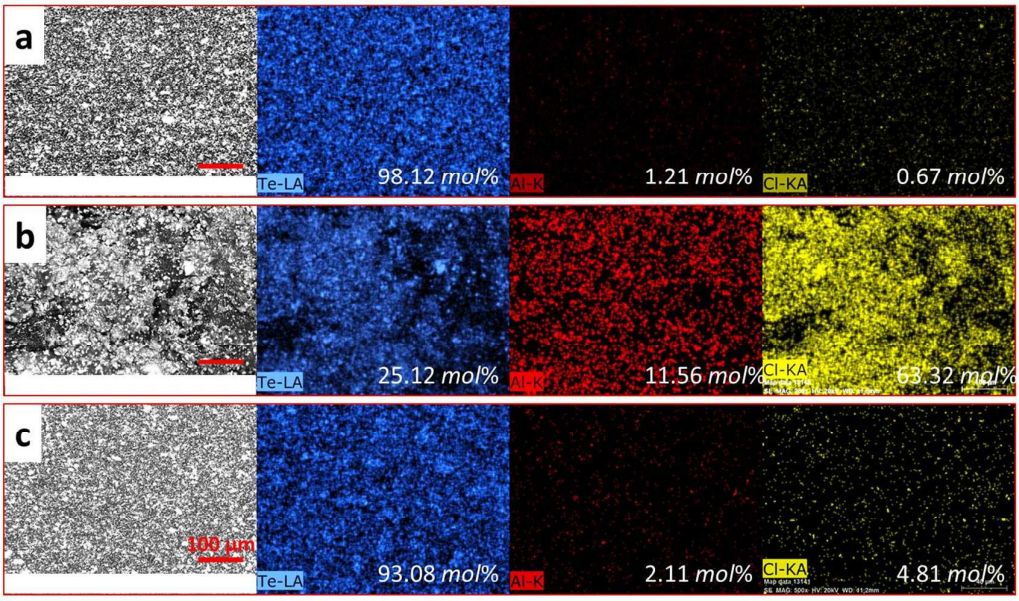

Figure S2: EDS of tellurium electrodes: (a) pristine, (b) charged to 2.4 V and (c) reverted to 0.5 V by discharge from 2.4 V.

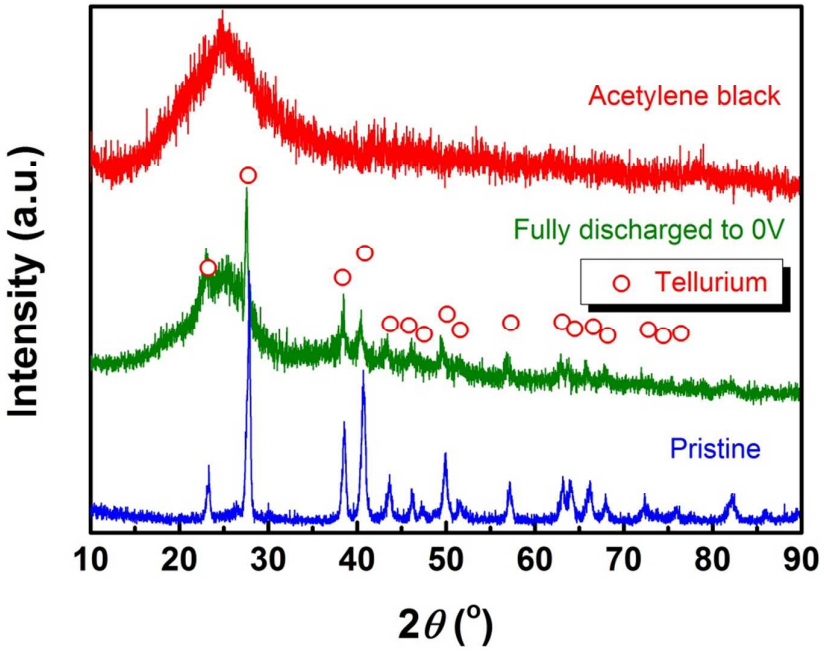

Figure S3: *Ex situ* X-ray diffraction patterns of tellurium cathode: pristine and fully discharged to 0 V.

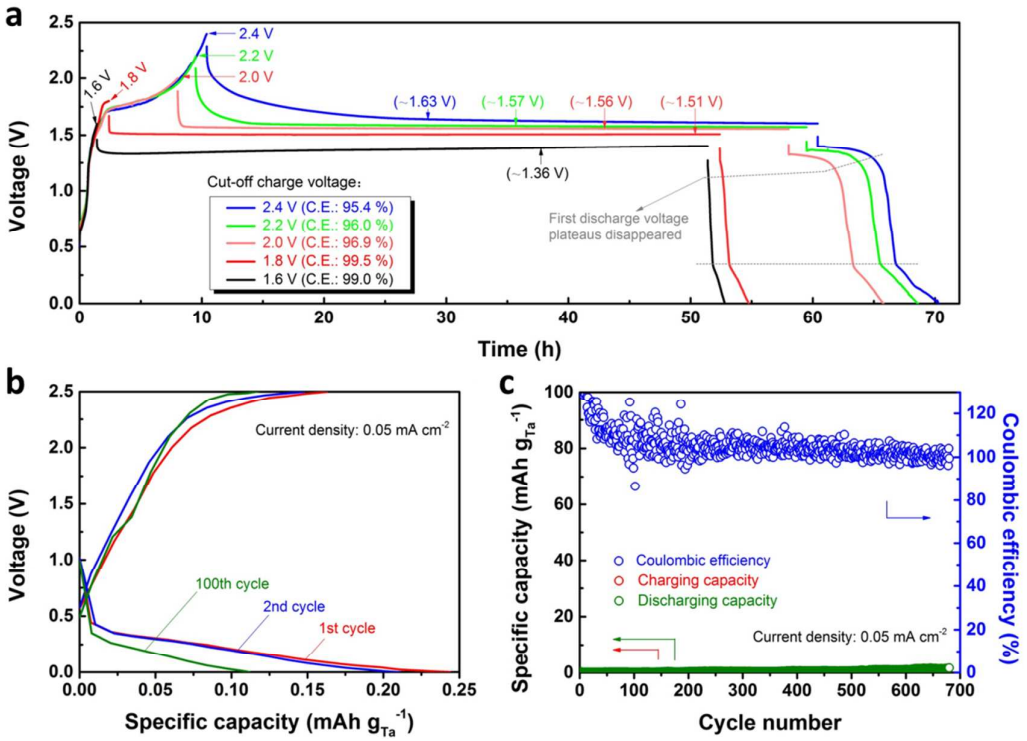

Figure S4: (a) The shelf life test of the Al-Te battery. (b) Charge/discharge curves of the tantalum foil. (c) Capacity as a function of cycle number of the tantalum foil at a current density of 0.05 mA/cm^2.

The capacity of tantalum foil is less than 0.5 mAh/g_{Ta} over 600 cycles, which indicates that the side reaction caused by tantalum is negligible.

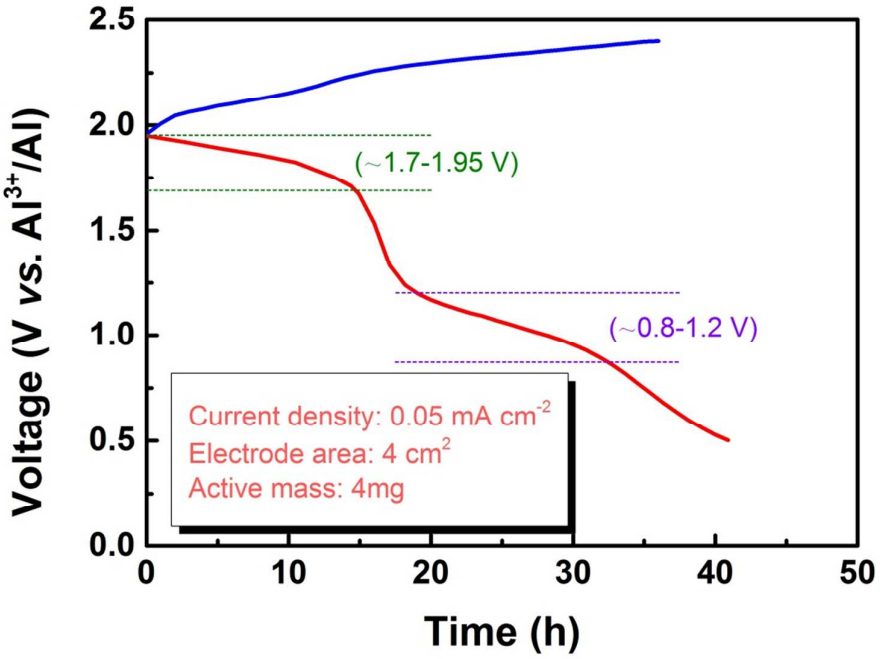

Figure S5: Galvanostatic charge and discharge curves of the novel Al-S battery at a current density of 0.05 mA/m^2.

Table S1: Theoretical redox potentials of tellurium and its compounds calculated from thermodynamic data at 298 K.

Equation	ΔG (kJ)	E (V *vs.* Al^{3+}/Al)
$3TeCl_4+2Al=2AlCl_3+3TeCl_2$	-1021.448	1.76
$3TeCl_2+2Al=2AlCl_3+3Te$	-788.619	1.36
$3TeCl_4+4Al=4AlCl_3+3Te$	-1810.067	1.56
$2Al+3Te=Al_2Te_3$	-314.076	0.54