

Supporting Information

Chemical equilibrium of Fe oxide state.

Figure S1 shows the Fe oxide state at marked temperature as a function of oxygen partial pressure so-called "Keringum diagram". Evidently, with decreasing temperature, oxygen partial pressure of Fe oxide with higher oxidation number becomes wider and so lower operation temperature of the cell has an advantage of larger theoretical capacity. It is also noted that at temperature lower than 873 K, 10^{-20} atm, the most stable phase of Fe oxide is Fe_2O_3 . Therefore, at room temperature, the most stable state of Fe is Fe_2O_3 , and at 873 K, $P_{\text{O}_2}=10^{-23.8}$ atm which is corresponded to 1.03 V terminal potential, discharge was performed by oxidation of Fe to Fe_3O_4 . The discharge P_{O_2} was pointed in Fig.S1. The theoretical discharge capacity was 1163 mAh/g-Fe and the observed capacity was 97% against theoretical one.

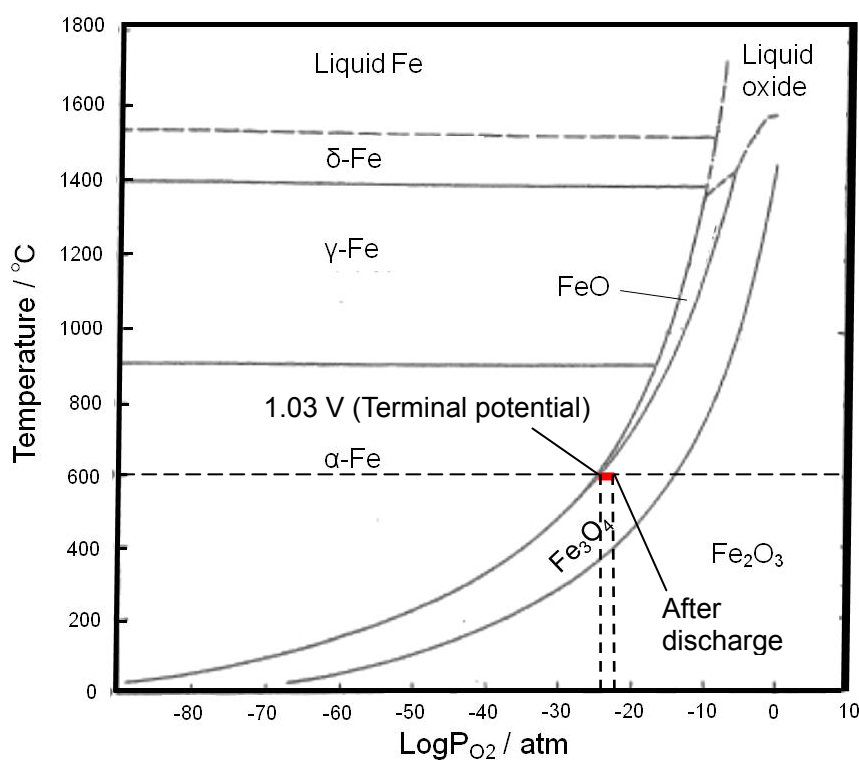


Figure S1 Fe oxide state at marked temperature as a function of oxygen partial pressure.

Figure S2 shows the XRD pattern of Fe powder after discharge. Evidently, oxidation product from Fe during discharge was Fe_3O_4 as expected from Keringum diagram in Fis.S1.

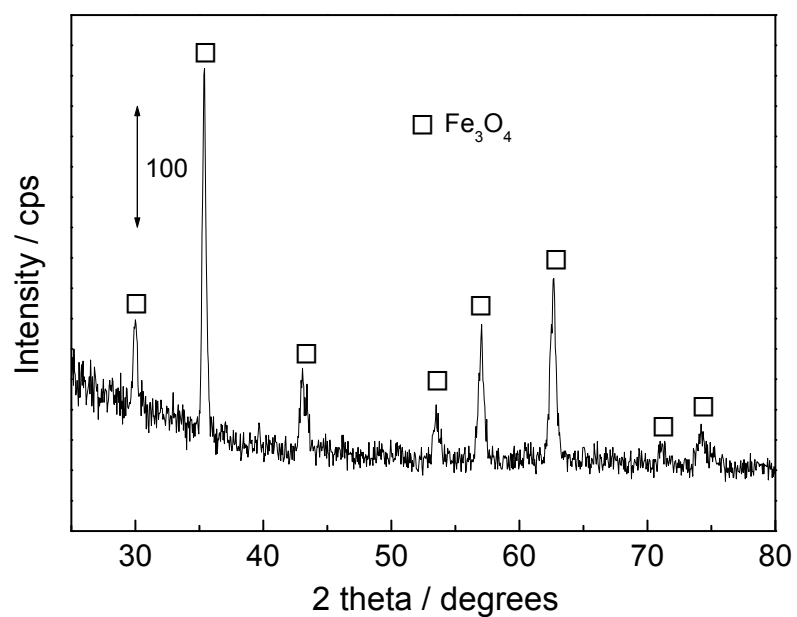


Figure S2 XRD pattern of Fe powder after discharge.