Evaluation of the dynamic modeling and discharge performance of a magnesium battery activated by seawater

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This study focuses on an evaluation of the dynamic modeling and discharge performance of magnesium battery activated by sea water. Modeling is important to determine the optimum condition of battery discharge operation. The modeling was performed by modifying the Shepherd model approach by combining an Rint equivalent circuit model to avoid the looping algorithm problem. Initial parameters were obtained from battery discharge manufacturing data on open operating systems. The battery anode used magnesium foil, the cathode used carbon, while the electrolyte used 3.5%wt NaCl solution. The battery discharge test to obtain manufacturing data was carried out with variations in current loads of 0.01 C, 0.05 C and 0.1 C until the potential and current were zero. Battery discharge performance evaluation can also be performed from manufacturing data analysis. Potential battery discharge decreased from ±1.49 V to ±1.30 V, while the battery discharge potential was relatively stable at ±1.30 V to the SOCmin potential value (±1.29 V). It can be seen from the different values of exponential and nominal potential that the parameters were not too significant. The modeling has convergence on the discharge parameters, such as E0 = 1.303 V; R = 0.012 ; Kdr = 0.01 ; Kdv = 5.794×10-4 V/A.h A = 0.195 V; and B = 140 (A.h)-1 . The SOCmin value of 5% indicates a minimum limit of battery operation that is permitted for battery performance to drop suddenly. The SOCmax value of 93% indicates the maximum allowable limit for the battery to operate stably. The percentage of simulated data error compared to the manufacturing data is 0.85%.