Analysis of Generalized Peukert's Equations for determining the capacity of nickel-cadmium batteries

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doi: 10.20964/2018.09.61

Received: 12 May 2018 / Accepted: 6 July 2018 / Published: 5 August 2018

In this paper, we analysed the use possibility of the generalized Peukert's equations $C = C_m / (1 + (i/i_0)^n)$, $C = 0.522 C_m \tanh((i/i_0)^n / 0.522) / (i/i_0)^n$, and $C = C_m \operatorname{erfc}((i/i_k - 1)/n) / \operatorname{erfc}(-1/n)$ to compute the released capacity of nickel-cadmium batteries at different discharge currents. It was proven that these equations correspond well to the experimental data throughout the entire variation interval of discharge currents. It was shown that the parameter n does not depend on the nominal capacity of the batteries under examination; however, it possesses various values for batteries of different modes of discharge (Long, Medium, High). Further, it was shown that the functional dependence of a battery's released capacity with a discharge current is determined by the statistical phase transition subjected to the normal distribution law. The proposed statistical mechanism allows us to explain the variation in parameter n depending on the types of batteries under examination.

Keywords: Peukert's equation, modeling, battery, nickel-cadmium, capacity

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