Discharge Capacity of Energy Storages as a Function of the Discharge Current –Expanding Peukert’s equation

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In 1897 Wilhelm Peukert tested lead-acid batteries with constant current and observed that a single equation can describe the relationship between the discharge capacity of the battery and a constant discharge current. In this article the dependence of the discharge capacity of lithium-ion battery cells, electrochemical double-layer capacitors and lithium capacitors are investigated from low to very high discharge rates. From low to intermediate discharge rates, these energy storage devices show ideal Peukert behavior, but a deviation was observed at high discharge rates. The cells provide less charge than predicted by Peukert’s Law. To describe this deviation, a new equation has been derived by expanding Peukert’s law to very discharge rates. It is capable to describe the discharge behavior of lithium-ion battery cells, electrochemical double-layer capacitors and lithium capacitors from low to high discharge rates in an unequivocal way.

Keywords: discharge capacity, lithium-ion cell, electrochemical double-layer capacitors, lithium capacitors, capacity, Peukert equation, discharge current

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