Reduction of aging-effects by supporting a conventional battery pack with ultracapacitors

This contribution investigates the reduction of aging-effects by using a hybrid energy storage system (HESS). The system consists of a Lithium-ion (Li-ion) battery and an ultracapacitor. The scenario is a challenging use-case in public-transport in a large megacity-Istanbul, Turkey. Mobility data was recorded onsite and used for a holistic vehicle model in order to carry out long-term aging simulations. The goal was to find out if and to what extent aging can be reduced by adding an ultracapacitor unit. It was analyzed if this measure would economically be better than reducing the battery aging impact by oversizing the battery. Results show that a HESS can increase a battery unit’s lifespan more cost effectively than the oversizing of the battery-only-storage, but not by a significant amount. The magnitude of the economic impact strongly depends on external factors, such as price fluctuations. Ultimately, it was found that the concept is not economically efficient, given the current technical and financial situation.