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Editorial

Advanced Energy Storage Technologies and Their Applications (AESA2017)

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Abstract: This editorial summarizes the performance of the special issue entitled Advanced Energy Storage Technologies and Applications (AESA), which is published in MDPI's Energies journal in 2017. The special issue includes a total of 22 papers from four countries. Lithium-ion battery, electric vehicle, and energy storage were the topics attracting the most attentions. New methods have been proposed with very sound results.

Keywords: lithium-ion battery; electric vehicle; energy storage

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To reduce the usage of fossil fuel and ease air pollution, many countries have put huge efforts to promote the development of electric vehicles. Lithium-ion batteries are the main power sources of electric vehicles, and have been the research focus in both industry and academia [1,2].

This special issue has focused on advanced energy storage technologies and their applications, which covers all kinds of energy storage and application fields, such as:

(1) Novel energy storage materials and topologies;
(2) Application in electrical/hybrid driven system and electrical/hybrid vehicles;
(3) Next generation energy storage devices, systems, or techniques;
(4) Large-scale energy storage system modeling, simulation and optimization, including testing and modeling ageing processes;
(5) Advanced energy storage management systems, including advanced control algorithms and fault diagnosis/online condition monitoring for energy storage systems;
(6) Business model for the application and deployment of energy storage;
(7) Lifecycle analysis, repurposing, and recycling.

After peer-reviewing, papers in high scientific quality and innovativeness were accepted. A total of twenty-two papers were accepted, with the following geographical distribution of authors:

(1) China (18).
(2) USA (2).
(3) Germany (1).

(4) Italy (1).

The lithium-ion battery has been investigated broadly, including equivalent circuit modeling and parameter estimation [3,4], state of charge and peak power estimation [5,6], battery pack equalization [7], and battery capacity decay [8]. Recently, battery heating-related characteristics have been a research focus. Zhu et al. [9] investigated an impedance-based temperature estimation method considering the electrochemical non-equilibrium with short-term relaxation time for facilitating vehicular application. Hong et al. [10] developed a thermal runaway prognosis scheme for battery systems in electric vehicles based on the big data platform and entropy method. The low-temperature preheating techniques of lithium-ion batteries were investigated in [11,12].

The driving performance of electric vehicles (EVs) is highly dependent on the energy distribution of the power sources and the electronics' reliability. Energy optimization strategies and automatic control techniques were investigated in [13–15]. Ding et al. [16] investigated the impact of silicon carbide (SiC) metal oxide semiconductor field effect transistors (MOSFETs) on the dynamic performance of permanent magnet synchronous motor (PMSM) drive systems. In another paper, Ding et al. [17] investigated the impact of SiC on the powertrain systems in EVs.

Other energy storage forms have also been investigated aside from lithium-ion batteries or DC-DC, including superconducting magnetic energy storage (SMES) [18], latent thermal energy storage (LTS) [19], and compressed air energy storage [20]. Refs. [21,22] investigated the design of pump-turbines.

Two reviews are presented in this special issue. Lanahan et al. [23] analyzed recent case studies—numerical and field experiments—seen by borehole thermal energy storage (BTES) in space heating and domestic hot water capacities, coupled with solar thermal energy. Benato et al. [24] offered a wide overview on the large-scale electrochemical energy projects installed in the high-voltage Italian grid. Detailed descriptions of energy (charge/discharge times of about 8 h) and power intensive (charge/discharge times ranging from 0.5 h to 4 h) installations were presented with some insights into the authorization procedures, safety features, and ancillary services.

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