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Preface

Electrochemical energy storage is a well-established, even an essential, facet of modern industrialized societies. Since the earliest uses of batteries of electrochemical cells, it has been clear that specific energy (Watt–hours stored per unit weight) is an important characteristic and that the higher the value of this parameter, the more applications become feasible.

In recent years, the additional demand for high specific power (Watts stored per unit weight) has been growing for a number of applications.

There have been occasional bursts of enthusiasm for electric vehicles to replace internal combustion engine vehicles through the last 100 years, none of which have resulted in a major break through to widespread acceptance. In a relatively short period of time, however, hybrid electric vehicles, in which the motive power stems partly from a relatively small internal combustion engine and partly from an electric motor, have emerged and immediately appear destined to be successful. Sales of the first model to become available have reached some 35 000 in the first 18 months that the vehicle has been on offer in Japan and there are substantial waiting lists in the United States. The batteries required for this important new market require very much higher levels of specific power than are needed for all-electric vehicles.

Internal combustion engine vehicles will not disappear of course and a major change appears to be on the horizon for their starting, lighting and ignition (sli) batteries. The problem of insufficient electrical power in a modern automobile has reached a critical point. Twelve volt systems are compromised by bulky wiring harnesses, heavy motors, and electronics that are subject to voltage irregularities. Moreover, the use of a whole new range of advanced components such as electronically actuated valves, flywheel starter alternators, and electronic brakes continues to go unrealized because there is just not enough power. The proposed move to a higher voltage system will overcome this problem. Currents, and therefore wire sizes, will be reduced and the electrical architecture of the vehicle will be rejuvenated. The new standard is for a tripling of the present voltage for both the battery (from 12 to 36 V) and the generator output (from 14 to 42 V). It is likely that new, high voltage system vehicles will have two batteries — one at 36 V for power and the other at 12 V for capacity.

Battery requirements in the military sector too are moving to higher power for a new range of devices that forward units need to use in the course of high-tech combat.

For all these emerging high power applications, the traditional batteries that have satisfied markets until now, with development concentrated on specific energy, are likely to prove inadequate. Much development of the traditional systems is currently underway in order to meet the new power demands and, in addition, new technologies such as supercapacitors are being considered for the contributions that they might make.

This special issue contains a series of articles by experts in the field describing in some detail the new, power-hungry applications and the technical developments that are being undertaken to meet the needs.

P.T. Moseley *
International Lead Zinc Research Organization Inc.,
PO Box 12036,
Research Triangle Park, NC 27709-2036, USA
E-mail address: pmoseley@ilzro.org

* Corresponding author. Tel.: +1-919-361-4647; fax: +1-919-361-1957.

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