

Traction batteries: automotive requirements, current status, and challenges ahead

Mark Verbrugge

Chemical Sciences and Materials Systems Lab

General Motors Research & Development

Warren, MI 48090-9055

The first portion of the lecture will relate global energy challenges, trends in personal transportation, and electrochemical energy storage technologies. Great progress has been made in recent years relative to battery technology. Primary concerns associated with lithium ion batteries and high-volume traction applications are associated with cost, life (cycle and calendar), and performance over a wide temperature range. Despite these concerns, it is well recognized that soon lithium ion batteries will be used in a variety of electrified vehicles, spanning from engine start/stop applications to hybrid electric vehicles to pure electric vehicles. Hence, it is critically important to understand phenomena governing the durability of lithium ion cells within the context of traction applications. This is especially true when we consider advanced battery systems that show promise for exceeding the performance of next-generation lithium ion technology (i.e., “beyond lithium ion” technologies).

We focus the technical part of this talk on the combined mechanical and chemical degradation of lithium ion electrode materials, including both recent theoretical and experimental methods to clarify the governing phenomena. We will overview requirements for plug-in hybrid electric vehicles (PHEVs) and extended-range electric vehicles (EREVs). Last, we will briefly overview three new approaches to providing high-performance negative electrodes.