Challenges in Batteries for Electric Vehicles

Sarah Stewart, Jake Christensen, & Aleksandar Kojic
Robert Bosch Research & Technology Center North America

By the year 2020 seven percent of vehicles being sold worldwide may be electric (including hybrids).[i] Replacing internal-combustion engines with batteries could reduce greenhouse-gas emissions and dependence on oil. Recent improvements in the cost & energy density of lithium-ion batteries have provided electric vehicles with more than 265 miles of range, however high initial costs limit mass-market acceptance.

The USDOE has called for a reduction in battery cost to $125/kWh by the year 2022 (current battery costs are ~$400 to $500/kWh). This needed reduction in cost can be accomplished by reducing material & manufacturing costs, and/or by increasing energy density (Wh/kg). Some estimate that lithium-ion batteries can improve 2-3 times more in energy density through the discovery of new materials & designs. Other chemistries, such as lithium air, may offer further increases in energy density (~5X) if technical challenges can be overcome. This talk will focus on the current challenges & recent advances in lithium-ion batteries and the chemistries that may replace them.

[i] D. Hurst & R. Gartner, Navigant Research, “Electric Vehicle Market Forecasts,” 2Q2013