BATTERY ANXIETY

Session co-chairs: Dan Steingart, Princeton University, and Jeff Sakamoto, University of Michigan

Approximately 82% of energy use in the United States consumes fossil fuels such as petroleum, coal, and natural gas. In terms of sustainability, minimizing dependence on fossil fuel and reducing CO_2 emissions are compelling arguments to electrify vehicles and augment the electric grid infrastructure. As efforts to bolster electrical energy production progress, affordable, high performance, and safe energy storage technology must also advance to enable the transition to an electrical energy economy. This session discusses future energy storage needs through fundamental and applied materials research.

Batteries, fundamentally, are compromises between safety, energy density, power density, cost and lifetime. This means that the materials required for batteries are actors in this compromise. In this session speakers will discuss the many ways materials can be engineered to exploit or mitigate systematic coupling, and the ways systems can be engineered to exploit their properties and address material limitations.

Realized in 1991, Li-ion batteries were rapidly commercialized for use in microelectronics and are currently considered state-of-the-art technology for vehicle electrification. Beyond traditional battery performance metrics (e.g. the Ragone Plot), widespread adoption of electric vehicles and advancing grid technology has been limited to due cost, and, safety constraints of current Li-ion technology. Are these constraints inherent to the technology? Can multi-disciplinary engineering address these constraints not only for Li-ion, but also for other promising battery chemistries? Or, are new chemistries that go beyond Li-ion necessary to keep pace with future energy storage demands? These aspects are discussed in this session.

The first speaker, Alvaro Masias from Ford, talks about battery life and safety research. The next speaker, Sarah Stewart, links fundamental behavior in batteries to manufacturing issues. Her experience at Tesla and Bosch, combined with her fundamental PhD work, gives her an unparalleled sense of translation issues. Specifically, she will share an overview of the challenges she saw while manufacturing battery packs and speak to how fundamental engineering research could improve the manufacturing cost and reliability of batteries. Next, Claus Daniel will articulate current and future battery chemistries into large-scale manufacturing for EVs and grid storage. Claus gives a national lab perspective representing the transition between materials discovery and energy storage technology maturation. The discussion also includes technology development perspectives from the Department of Energy, automotive, and electric utility industries. The final speaker, Shirley Meng, will cover materials and battery design from the ideal or theoretical perspective. The discussion is holistic, spanning a range of topics to include atomic scale phenomena, nanoarchitectures, charge transport, and prototypical batteries.