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**Facilitating Li-Ion Battery Advancement With Hard X-ray Photoelectron Spectroscopy**

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Portable electronic devices and the robust research effort to improve batteries supplying power to them have increased each others popularity for more than 30 years. This has furnished batteries that work acceptably well for handheld electronics, but are insufficient for more demanding applications like electric vehicles. Greater energy density and power output, as well as reduced charging time and cost, for instance, are desirable facets next-generation batteries ought to have in order to facilitate industrial conversion to hybrid and all-electric vehicles. Researchers across industry and academia are presently attempting to improve battery technology to meet these goals.

Many attempts to improve battery technology, both successful and unsuccessful, may be characterized by analysis of a passivation layer that grows on battery electrodes during regular charge/discharge cycling. X-ray photoelectron spectroscopy (XPS) is a popular tool for this analysis but the higher energy version of this technique, HAXPES, can offer additional information, including depth-sensitive profiling of the chemical environment using synchrotron radiation.

Some of the most pressing challenges to development of superior Li-ion rechargeable battery solutions for demanding applications are presented, as well as proposed solutions and lessons learned about them from HAXPES analysis performed at Brookhaven National Laboratory and at the Canadian Light Source.