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How can one tell if a lithium-ion battery will last for 10 years in experiments that only take a few weeks?[1]

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Lithium-ion batteries are now being used in electric vehicles. There are four main factors which will determine the success of Li-ion batteries in this application: a) safety; b) cost; c) performance and d) lifetime. Each of the factors is presently the subject of much debate and much R+D. I will only speak about lifetime here. Testing the lifetime of Li-ion batteries for automotive applications under **realistic** conditions of temperature and number of cycles per day is very time consuming. In fact, such a test should take a decade or more, if the batteries are expected to last a decade in the field. Tests of such duration slow the product improvement cycle immensely. In this lecture, I will discuss how high precision measurements of the coulombic efficiency of Li-ion cells and batteries can be used to predict the relative lifetimes, on the decade-long scale, of these devices in measurements that only take a few weeks. The measurements enable the rapid comparison of technologies using new electrode materials, electrolyte additives and cell designs so that the product improvement cycle can be significantly shortened. I will describe the requirements of the instruments needed to make these measurements and point out that nothing suitable is, as yet, commercially available. There is a major need for such equipment and an associated business opportunity.

[1]In collaboration with Chris Burns, Aaron Smith, Nupur Sinha, and Hannah Dahn, Dalhousie University.