

COMPARING SAMPLE PREPARATION STRATEGIES FOR THE DETERMINATION OF MAJOR COMPONENTS IN BLACK MASS WITH THE AVIO® 550 MAX ICP-OES. Ken Neubauer, **Aaron Hineman**, PerkinElmer, 710 Bridgeport Ave, Shelton, CT, 06484, USA. (Aaron.Hineman@PERKINELMER.COM)

With the growing adoption and use of lithium-ion batteries, the need to increase production has also risen. A major challenge of increasing production is acquiring the necessary raw materials, particularly elements common in cathode materials, and while these elements can be extracted from the earth, expanding mining operations has a large negative environmental impact. One way to minimize the negative environmental impact of lithium-ion battery production is through recycling by recovering important metals from spent batteries and using them to make new ones. One of the most common recycling methods involves shredding and incineration of batteries, which results in “black mass” – a mixture of metals, ash, graphite, and residual electrolyte – which must be analyzed both for elements of interest (primarily cathode elements) as well as other high-level contaminants. Because of the complex nature of black mass and the concentrations of interest, ICP-OES is the technique of choice for the analysis, however, a major analytical challenge involves sample preparation: since ICP-OES can only analyze samples in liquid form, the black mass must be converted to a liquid for analysis. With the amounts of ash and graphite present, this poses a challenge. This work compares sample preparation methods for battery recycling black mass (aqua regia leaching, microwave digestion, and lithium and sodium fusions), with analysis using the Avio® 550 Max ICP-OES. Each sample preparation strategy has advantages and limitations, both in execution and considering the elements measured. The Avio 550 Max fully simultaneous ICP-OES easily performs measurements from each sample preparation methodology and provides initial sample screening through SmartQuant™, allowing users to determine which elements may be present in various concentration ranges.