Research project and supervisor team

Supervisory Team	Prof. Nick Miles Dr. Philip Hall Dr. Zheng Wang
Short introduction & description of research project	Lithium-ion batteries (LIBs) have an established role in the consumer electronics markets with minimum risk of replacement from any other contender in the near future. The recent momentum towards electric vehicles and the renewable energy storage market is creating an increased demand for LIBs. The large amount of hazardous waste generated from the disposal of LIBs is driving research into a sustainable approach for LIB treatment and recovery. The positive electrode active materials being the main targeted component as it is the greatest cost contributor to LIBs production. During the production of the positive electrode, a powder of active material typically Lithium Cobalt Oxide is applied to aluminium foil and held together using a polyvinylidene fluoride (PVDF) binder. The recovery of positive electrode active material involves physical and chemical treatment. Where effective and efficient physical treatment would reduce the cost incurred for the subsequent chemical treatment. In recent years, much research has been focused on developing efficient recovery methods for the materials found in spent LIBs. With the positive electrode active materials as the main targeted component as it is where the incentive of LIBs recycling come from. Current research to recover positive electrode active materials are focused on leaching processes. Recycling of other components in spend LIBs like graphite, copper and aluminium current collector are rarely studies. The process developed by this team utilize several mineral process technique to provide full component recycling of spent LIBs. This incudes: 1) preliminary shredding for size reduction; 2) attrition scrubbing for liberation of cathode/anode material; 3) electrostatic separator for recovery of current collector and plastic separator; 4) forth flotation to separate cathode material and graphite. This process has been carried out in the lab scale with overall recycling efficiency of greater than 90%. Because of the wet nature of this process, large amount of waste water will be produced from attrition process. The waste water produced could be reused in the attrition process for several cycles, however, the build-up of organic solvent need to be removed eventually. This project would develop environmental sound approach to recycle and dispose the electrolyte from waste LIBs. Possible approaches include liquid phase extraction and photochemical oxidation.
Contact points	Dr. Philip Hall Philip.hall@nottingham.edu.cn Dr. Zheng Wang zheng.wang@nottingham.edu.cn