

Design of efficient and safe solid electrolytes for Li-ion batteries

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Lithium ion batteries are the power source of choice for portable electrical devices (laptops and mobile phones) owing to their superior performance in terms of high specific capacity and reliability. The use of Li-ion batteries is predicted to grow substantially in the short to medium term into new areas such as automotive propulsion and energy storage systems with global revenues expected to rise to £40 billion in 2020. Despite this rising demand, we presently lack safe, easy to process and thus low-cost, ideally mechanically flexible batteries.

This project will explore several avenues to solve this important problem: (i) ion-conducting polymers that can achieve a decoupling between ionic transport and segmental polymer motions thus combining good ionic transport, safety and mechanical rigidity (ii) polymer gels based on ionic liquids where the polymer aids the formation of a solid state and the ionic liquid provides a safe and efficient ionic transport (iii) plastic crystal-based electrolytes that combine rigidity with good ionic transport due to separation of translational and rotational degrees of freedom.

The aim of the project is to define a new direction for polymer electrolytes which can deliver the elusive combination of high ionic conductivity, safety, and optimised mechanical properties necessary to make a breakthrough in the design of Li-ion batteries.