Graduated with B.Eng and M.Eng from Tsinghua University, Lu continued his doctoral study in KU Leuven after three years working in Zhejiang University. After two years post-doctoral studies in KU Leuven, Dr. Lu joined National University of Singapore in 1991. His current main research covers Li-ion batteries, solid ion conductors and future solid state battery, and supercapacitors. Dr. Lu has published 3 monographs, over 400 international journal papers and delivered numerous Plenary, Keynote and Invited Lectured in international conferences. He has over 14, 000 citations with h-index 62.

Dr. Lu is Editor-in-Chief of Functional Materials, and Associate Editor of Materials Technology – Advanced Performance Materials.

Solid state electrolyte for solid state batteries and air batteries

Li Lu
Department of Mechanical Engineering
National University of Singapore

Solid state electrolytes have attracted tremendous attentions in recent years due largely to their commercial applications for highly safe energy storage and large energy storage devices. Although solid state electrolytes been studied for a few decades, breakthrough in ionic conductivity has been noted only recently. With applications of batteries in large format, safety issues become an extremely important in addition to challenges of high energy density. Replacement of highly flammable organic liquid electrolyte by solid and stable electrolyte leads to increased safety. Most solid electrolytes possess a wide operation potential range so that some cathodes materials that cannot be used in organic electrolyte can now be considered. Studies also note that use of solid electrolyte can significantly expand battery operation temperature range. Therefore, solid state battery is the future energy storage device. Solid electrolyte that is a key and also an essential component in the batteries can be categorized into following types: oxide, glassy, sulfate, and polymer and its composites. Different types of solid electrolytes show different advantages in different aspects. Based on safety concern, oxide-based electrolytes such as garnet-structured, nasicon-structured and lisicon-structured materials have demonstrated pretty good stability in ambient condition with reasonably high ionic conductivity of about 10^{-4} ~ 10^{-3} S/cm. Some of them can be potentially used in all-solid-state batteries and Li-air batteries. This presentation will report our recent development of solid state electrolyte for Li-air batteries and for all-solid-state batteries.