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Current situation of spent lithium-ion battery recycling in China

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In recent years, with the rapid upgrade and replacement of new energy vehicle, as well as electronic devices, huge amounts of spent lithium-ion batteries (LIBs) are generated worldwide. In view of the growing interest in environmental protection and resources sustainable use, recovery of spent LIBs is becoming increasingly important. The Chinese government uses the term new energy vehicles (NEVs) to designate plug-in electric vehicles. There are battery electric vehicles and hybrid electric vehicles inducing purchase incentives. The fleet of NEVs in China is the second largest in the world after the United States, with cumulative sales of around 300,000 plug-in cars sold since 2011 through March 2016. China is creating a favorable environment to foster quicker growth in the NEV sector through intense government-led promotion. The guideline set the target of 200,000 units of new energy buses and 100,000 new energy taxes and city logistics delivery vehicles by 2020 to encourage the production and purchase of NEVs. For post-consumer new energy battery recycling, an environmental benign process namely mechanochemical approach was developed for cobalt and lithium recovery from spent LIBs in the current study. The main merit of the process is that neither corrosive acid nor strong oxidant was used. In the proposed process, lithium cobalt oxide (obtained from spent LIBs) was co-grinded with various additives in a hermetic ball milling system, followed by a water leaching procedure. Experiment results indicated that EDTA was the most suitable co-grinding reagent, and 98% of Co and 99% of Li were respectively recovered under optimum conditions: LiCoO, to EDTA mass ratio 1:4, milling time 4 h, rotary speed 600 r/min and ball-to-powder ratio 80:1, respectively. Mechanisms study implied that lone pair electrons provided by two nitrogen atoms and four hydroxyl oxygen atoms of EDTA could enter the empty orbit of Co and Li by solid-solid reaction, thus forming stable and water-soluble metal complexes Li-EDTA and Co-EDTA. Moreover, the separation of Co and Li could be achieved through a chemical precipitation approach. This study provides a high efficiency and environmentally friendly process for Co and Li recovery from spent LIBs.

Biography

Fu-Shen Zhang, PhD, is a Professor and Director of Solid Waste Treatment and Recycling Lab at Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. His recent research addresses effective recycling of solid wastes, including valuable matters recovery and functional materials development from electronic waste, construction waste, municipal solid waste and bio-waste. He has guided ten PhD, MSc students and several Postdoctoral Research Fellows in the field of Environmental Engineering. He has published around one hundred peer review articles and applied more than thirty patents.

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