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Closing the lithium-ion battery life cycle

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Electric drive vehicle sales are growing worldwide. The key component in these vehicles is the lithium-ion (Li-ion) battery. While it is possible to extend the life of Li-ion batteries in applications such as grid storage, eventually they reach their end-of-life (EOL) and are available for recycling. The reason behind recycling these batteries include: to reduce net energy requirements; to reduce environmental impacts; to reduce potential supply constraints by replacing extracted materials with recovered materials; to generate cost-offsetting revenues and; to comply with government mandates for EOL battery recycling. To identify the potential impacts of the growing market for automotive lithium-ion batteries, Argonne researchers are examining the material demand and recycling issues related to lithium-ion batteries. Research includes: estimating material demand and comparing to world supplies; conducting studies to identify the greenest, most economical recycling processes; investigating recycling practices to determine how much of which materials could be recovered with current or improved methods, and; quantifying the environmental impacts of both battery production and recycling processes through life-cycle analyses using Argonne's GREET model. Researchers leverage Argonne's Bat Pac model to determine the material quantities and compositions needed to perform demand studies and life-cycle analyses on different lithium-ion battery chemistries. Although there are many challenges to successful recycling of lithium-ion batteries, we are confident that the research we are pursuing will be instrumental in overcoming them.

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Butyl rubber recycling by means of gamma radiation followed by mechanical shear

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Polymeric materials (plastics and rubbers) cover a continuously raising proportion of urban and industrial solid wastes discarded in landfills and consequently their impact on environment are of more and more concern. Rubbers exhibit a very slow natural decomposition due to their chemical structure weather resistant as well to enzymatic degradation and to microorganisms. Rubber recovering is hampered by its insolubility caused by crosslinked structures. Besides, this tridimensional structure causes various problems for material recovering and reprocessing. Just 8% to 12% of polymeric residues are thermoplastic polymers; remaining are elastomers especially post consumption tires. It is relevant to emphasize that the crosslinking is essential for practical use of rubber and this process is worldwide known as vulcanizing process, discovered by North American Charles Goodyear. The implementation of new technologies in order to reduce polymeric residues, acceptable from the environmental viewpoint and at an effective cost proved to be a great problem due to inherent complexities for polymers reuse. Ionizing radiation has capacity to change structure and properties of polymeric materials. Butyl rubbers have been used in wide scale within a variety of applications such as tires spare-parts and diverse artifacts. Major effect of high energy photon, such as gamma rays in butyl and halo-butyl rubbers is the creation of free radicals accompanied by changes in mechanical properties. This work aims to the development of processes of controlled degradation (de-vulcanizing) of butyl rubber in order to characterize their availability for modification and changes of their properties. Experimental results obtained showed that butyl rubbers irradiated at 25 kGy and further sheared can be used as the starting point for mixtures with pristine rubber.

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