
电动汽车动力电池生命周期评价建模与评价

摘 要

近年来我国汽车不断增加，为环境带来了负担与压力，如资源消耗、环境污染等各种问题。为有效解决这一问题，新能源汽车尤其是电动汽车登上舞台，为节能减排做出贡献。本文以生命周期评价理论为方法，借助 eBalance 软件建模并进行清单分析，根据特征化与归一化结果对电动汽车动力电池给予评价。

文章以北汽新能源 EU5 为例，对磷酸铁锂电池和镍氢电池进行生命周期评价，通过在 eBalance 软件中对两款电池的原材料的获取、制造、使用、回收再利用四个阶段分别建模并进行清单分析，对模型与数据进行特征化与归一化分析得出结论。结果表明，磷酸铁锂离子电池的全生命周期的能耗和排放要小于镍氢电池，尤其是在使用阶段。就两款动力电池整体而言，使用阶段的能耗与排放远大于其余阶段，且两款电池的回收再利用都可以得到原材料以及部分能源，具有可持续意义。

本文的生命周期评价模型及结果解释是为了评价两款电动汽车动力电池在其全生命周期中对环境的影响，其结果可为电动汽车生产企业提供理论支持，也可为促进社会可持续发展做出贡献。

关键词：动力电池；生命周期评价；环境影响评价

Abstract

In recent years, the increasing number of cars in China has brought burden and pressure to the environment, such as resource consumption, environmental pollution and other problems. In order to effectively solve this problem, new energy vehicles, especially electric vehicles, have stepped onto the stage and made contributions to energy conservation and emission reduction. In this paper, the life cycle assessment theory is used as a method, and ebalance software is used to model and analyze the list. According to the results of characterization and normalization, the evaluation of electric vehicle power battery is given.

This paper takes Beiqi new energy EU5 as an example to evaluate the life cycle of lithium iron phosphate battery and nickel hydrogen battery. Through modeling and inventory analysis of the four stages of raw materials acquisition, manufacturing, use and recycling of the two batteries in ebalance software, the model and data are characterized and normalized. The results show that the energy consumption and emission of lifecycles of lithium iron phosphate battery are less than that of NiMH battery, especially in the use stage. As for the two power batteries as a whole, the energy consumption and emission in the use stage are far greater than that in the rest stage, and the recycling of the two batteries can get raw materials and part of the energy, which is of sustainable significance.

The life cycle assessment model and result interpretation of this paper is to evaluate the impact of two electric vehicle power batteries on the environment in their whole life cycle. The results can provide theoretical support for electric vehicle manufacturers and contribute to the sustainable development of society.

Key words: power battery; life cycle assessment; environmental impact assessment

1 绪 论

1.1 研究背景

汽车产业是我国国民经济的重要支柱产业之一，它是我国两个强国建设的重要支撑和融合载体。根据人民网数据，公安部交通管理局 2018 年 7 月 16 日发布，截至 6 月底，全国机动车保有量达 3.19 亿辆。其中 2012~2018 新车销量如图 1.1 所示。



图 1.1 2012-2018 新车销量

汽车在给人类带来不仅只有好处也给人们带来了负面影响与压力，如资源消耗、环境污染等问题已不容忽视。我国石油储藏量和开采量有限且为不可再生资源，石油资源的使用相较于以往而言愈发依赖进口，目前我国已成为世界第一大石油进口国，石油紧缺问题已不容忽视。其次随着汽车保有量的增加，对环境造成了严重影响。近二十年来，环境恶化越发严重，温室效应等各种问题陆续出现。2019 年 7 月，我国各地正式开始实施国家第六阶段机动车排放标准，尾气排放造成的大气污染相较以往有所减轻但仍占据大比重且与温室效应的产生有直接关系。

我国资源与环境都因传统内燃机汽车的出现及使用而产生了巨大压力。为减轻众多压力与问题，国家大力发展新能源汽车，尤其是电动汽车。电动汽车与内燃机汽车相比，在使用阶段仅消耗电能，可达到零排放或较低排放，较为环保、减轻温室效应；其驱动

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