Moving Towards a Sustainable Design of Power Converters Contributing to Zero-Emissions in the EV Use Phase and Lower Environmental Impacts in its Production: A Material Assessment with respect to Recyclability Aspects

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ABSTRACT

Electric Vehicle (EV) is a growing sector considered as one of the potential solutions for decarbonization. Therefore, there is a need for innovative strategies addressing sustainable design and manufacturing of the different components of EVs, such as power conversion systems. To this aim, in the frame of the European project SCAPE, this work analyses the environmental impacts associated with key materials from parts and auxiliaries of a conventional EV power converter. The Life Cycle Assessment (LCA) methodology was used to perform the assessment. Four end-of-life scenarios with different recyclability rates per material category were evaluated considering optimistic, pessimist and current recoverability rates. Results showed the consumption of non-renewable energy resources mainly based on fossil fuels as the major contributor to environmental impacts. Particularly, metals from the printing circuit board, such as gold, silver, and Copper + Molybdenum are the largest contributors. Recycling scenarios led to savings of up to 40% among impact categories.

KEYWORDS

Electric Vehicles, Power Converter, Electronic Components, Critical Raw Materials, Life Cycle Assessment, CO_2 eq emissions, Metal Depletion