

A Bibliometric Analysis on Electrochemical Impedance Spectroscopy of Batteries

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Energy storage has become crucial for various industries with technological developments and increasing energy demand. One of the most widely utilised energy storage technologies, batteries have been employed in different applications for many years. Several battery chemistries have been developed to satisfy the demands of these applications efficiently. They comprise lead-acid, nickel-metal hydride, nickel-cadmium, lithium-ion, sodium-nickel chloride, sodium-sulphur and flow batteries.

The increasing use of batteries in current applications and the complexity or development of the systems inside them have brought them into the focus of research. In these applications, the aim is to have batteries with greater efficiency, better performance, longer lifetime, higher security, and lower costs. For this purpose, it is essential to estimate the characterisation parameters of the batteries accurately. Many methods have been developed to understand the physical and chemical structure of batteries. The electrochemical impedance spectroscopy (EIS) draws attention among these methods since it is a robust method that provides a strong correlation with internal and external conditions of the electrochemical systems, such as batteries without damaging them.

The main purpose of this study is to give an idea about the history of the development of EIS, which has been used extensively for batteries in recent years, and to investigate this method in all its aspects with bibliometric analysis. In line with this target, all articles in the literature about the EIS method for batteries via the Scopus database are identified. The keywords such as electrochemical impedance spectroscopy, batteries and their integration are used to search all the articles from past to present. All identified articles are analysed according to the year of publication, the journals they were published in, the number of citations, the types of studies, and common keywords. VOSviewer software is used for visualising common connections between these articles. Furthermore, it is determined that these articles shed light on which characteristics of the batteries can be improved upon with the EIS method. In addition, ideas about what other features this method can offer for batteries and suggestions for developing the technique are presented.