

Development of Rechargeable Cement-based Batteries with Hemp Fibers**ABSTRACT**

Due to the growing demand for sustainable energy and smart infrastructure, the development of new, efficient and environmentally friendly energy storage devices is one of the key directions of current research. In this paper, a new rechargeable cement-based battery was prepared by selecting hemp fiber as an additive. The addition of hemp fiber will produce a large number of pore structures in the cementitious electrolyte, and this pore structure is conducive to the enhancement of the electrical performance of the cementitious battery. The experimental study contains electrochemical impedance spectroscopy and charge/discharge cycles to evaluate the performance of the battery. The results showed that the incorporation of hemp fibers significantly enhanced the electrical performance of the cement-based battery. At a fiber content of 4%, the battery exhibited stability in terms of discharge capacity, efficiency and energy density, with a maximum energy density of 12.73 Wh/m², which is significantly higher than similar batteries previously reported. In conclusion, this research provides new ideas for the development of cement-based batteries and lays the foundation for smart bridges and smart city construction.

Keywords: Rechargeable cement-based batteries; Hemp fiber; Cement electrolyte; Multifunctional building materials