Study on Electrochemical Impedance Response of Sulfate Saline Soil

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Since salt expansion of sulfate saline soil has great adverse effects on the engineering, it is significant to conduct the non-destructive test of salinity and water content of sulfate saline soil in the treatment process. To accurately detect the variation, electrochemical impedance characteristics of sodium sulfate content and water content in sulfate saline soil were studied by Electrochemical Impedance Spectroscopy (EIS), and the response strain of electrical impedance in sulfate saline soil was obtained under different salinity and water content. Through the data fitting of Zview software, the corresponding Bode and Nyquist diagrams were obtained, and the equivalent circuit model (ECM) was correspondingly analyzed to obtain the electrical impedance variation law of sulfate saline soil under different conditions of salinity and water content. The experimental results show that the electrical impedance modulus ($|Z|$) decreases with the increase of salinity and water content of sulfate saline soil. By evaluating and calibrating the $|Z|$ of sulfate saline soil under different water content and salinity conditions, the negative exponential relationship between the partial total resistance of the soil pore solution (R_1) and the connected micro-pore resistance (R_2) of the equivalent circuit element and the water content and salinity were obtained. Positive exponential correlation with a contact interface capacitance (CPE); and the prediction equations of water content and salinity of sulfate saline soil were deduced by using R_1 and R_2 . This study further enriches the application of EIS technology in geotechnical engineering.

Keywords: EIS; sulfate saline soil; salinity; water content; ECM.

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