

Porosity Assessment of Battery Separators Using Terahertz Technology

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Abstract: In this study, we aimed to investigate the porosity of the separator, which is a key component of batteries, utilizing terahertz (THz) technology. Initially, two battery separator specimens with different porosities were prepared, and THz time-domain spectroscopy (THz-TDS) transmission mode was used to measure THz signals with respect to porosities. An equation for separator porosity was derived based on the reflectance and absorbance of THz signals. Then, the porosity of the separators was calculated from the measured THz signals. Subsequently, THz scanning of the separator specimens was conducted to examine the porosity distribution across the entire separator area. To clearly visualize the regions according to separator porosities, the measured THz signals were subjected to Fast Fourier Transform (FFT) to analyze the frequency domain response of the separators. Then, the 2.5~3.5 THz range, where THz signals responded, was selectively filtered using a bandpass filter. As a result, the processed THz scanning results provided a clear depiction of the regions according to the separator porosities. This study demonstrates the potential of THz technology to enable real-time inspection of separator porosity in battery separators, which was previously challenging using conventional methods. **Acknowledgements** This work was supported by Korea Institute of Energy Technology Evaluation and Planning(KETEP) grant funded by the Korea government(MOTIE)(20212020800090, Development and Demonstration of Energy-Efficiency Enhanced Technology for Temperature-Controlled Transportation and Logistics Center). This work was also supported by the Agency For Defense Development by the Korean Government(UD230502DD). This research was also supported by a National Research Foundation of Korea (NRF) grant funded by the Korean Government (MEST) (2021M2E6A1084690). This work was also supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. RS-2023-00260527).