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Title

The quantitative monitoring of mechanochemical reaction between solid L-tartaric acid and sodium carbonate monohydrate by terahertz spectroscopy

Source

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Abstract

The solid-state reaction of chiral tartaric acid and alkali carbonate was studied by terahertz time-domain spectroscopy (THz-TDS). The sodium tartrate dihydrate was synthesized with high efficiency by mechanical grinding in the solid-state without waste that is particularly sustainable and environmentally benign. Distinct THz absorptions were observed for reactants and products. It indicates that THz spectroscopy is sensitive to different materials and crystal structures. The characteristic THz absorption peak at 1.09 THz of L (+)-Tartaric acid was selected for quantitative analysis. The reaction kinetics could be expressed by the Second-order equation and the Jander equation, which is consistent with a three-dimensional diffusion mechanism. The combination of multi-techniques including synchrotron radiation X-ray powder diffraction (SRXRPD), Fourier transform infrared (FT-IR) and scanning electron microscopy (SEM) was used to investigate the grinding process and presented supporting evidences. The results demonstrate that THz spectroscopy technique has great potential applications in process monitoring and analysis in pharmaceutical and chemical synthesis industry.