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POS-30 Photoacoustic FTIR as an isotopic analysis technique

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Fourier Transform Infrared (FTIR) spectroscopic techniques are well established for their ability to identify mixtures of compounds and polymorphs in solid materials. These spectra can be recorded using either optical or acoustic detectors. Transmission FTIR spectroscopy (FTIR-TR) has been used in the past to access crystallinity differences in archaeological and lab-produced calcium carbonate samples by examining the spectral peak positions and relative peak heights. Examining the same samples using a photoacoustic detector (FTIR-PAS) showed a roughly 3-fold enhancement to isotopic peak intensities of calcite that were poorly resolved above noise level using FTIR-TR. Surprisingly, the origin of this enhancement of weak peaks is not clearly described in the literature. Here we show that, because of the weak peak enhancement, FTIR-PAS is a useful isotopic analysis tool. Common data collection and processing parameters (mirror speed, spectral windowing and phase correction) were eliminated as potential causes for the observed peak enhancements. Particle size effect studies using monodisperse silica showed an over-all signal increase. From these results, we concluded that the origin of the isotopic peak enhancement is inherent to the acoustic detection. This isotopic peak enhancement makes PAS detection the method of choice for those in fields such as archaeology, geology or the petroleum industry. Offering a combination not observed in more traditional methods such as X-Ray diffraction, X-ray absorption fine structure or transmission electron microscopy, FTIR-PAS offers rapid, non-destructive identification of both solid sample isotope content and structural information which can be used to infer the formation conditions and processes of undergone by the material.

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