273. Title:Measurement and analysis of the diffuse reflectance of powdered samples at terahertz frequencies using a quantum cascade laser

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Abstract:We report terahertz (THz) diffuse reflectance measurements of bulk powdered samples at a frequency of 2.83 THz using a narrowband quantum cascade laser. Samples studied comprise polydisperse powders with absorption coefficients extending over two orders of magnitude from ∼3 cm-1 to 200 cm-1. Diffuse reflectance measurements are used to obtain the effective absorption coefficient of these samples from the backscattering cross-section, predicted under the quasi-crystalline approximation (QCA) in the T-matrix formulation and in conjunction with the Percus-Yevick pair distribution function. Results are compared with effective absorption coefficients obtained from THz time-domain spectroscopy measurements on pressed pellet samples, and show good agreement over the range of effective absorption coefficients studied. We observe that the backscattering cross-section predicted under the QCA is strongly dependent on both the real and imaginary components of the complex permittivity of the sample, and we show that reliable determination of the absorption coefficient from diffuse reflectance measurements therefore requires knowledge of the samples refractive index. This work demonstrates the applicability of diffuse reflectance measurements, using a THz frequency quantum cascade laser, to the high-resolution spectroscopic analysis of bulk powdered samples at THz frequencies.