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PHASE REFERENCE MATERIALS  
FOR PHOTOACOUSTIC SPECTROSCOPY

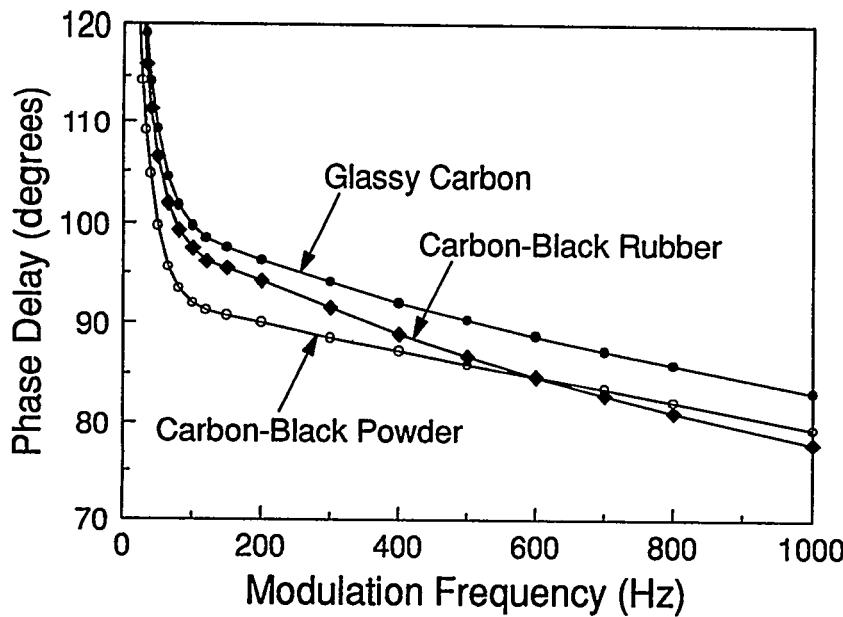
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Interest in the phase of photoacoustic signals has increased greatly since the advent of phase modulation in FTIR spectroscopy. The photoacoustic phase provides information on the depth of the light-absorbing species within a solid sample. A spectroscopist needs data from a phase-reference material for standardizing phase measurements and for correcting for instrumental effects on the observed phase. Unfortunately, there is no universally accepted phase-reference material.

We have studied the photoacoustic-signal phase and magnitude behavior for several potential phase-reference materials as a function of experimental parameters, such as beam modulation frequency, sample position in the photoacoustic cell, and cell purge gas. Theoretically, an ideal surface-absorbing material would have a photoacoustic phase that trails the phase of the excitation light by 90°. We have found no material with this behavior, although some come close under a limited range of conditions. The figure below shows the type of behavior we have observed. The three samples were separately sealed in the photoacoustic detector and illuminated by a red LED that was modulated at selected frequencies. The phases of the samples vary rapidly at very low frequencies because of the response of the cell microphone. Above that range, all three are within 10° of the ideal 90°, but each varies linearly with frequency with a different slope. The behaviors of these and other samples will be discussed in detail.



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