photothermal spectroscopy of solid surfaces

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We have succeeded in carrying out one of the ultra sensitive photother-mal classes which is Photothermal Deflection Spectroscopy (PDS) or (Mirage Effect). This has been done for the first time in Egypt with local means. We have also employed the PDS technique to study the optical and thermal properties of solid/air interfaces. The PDS is based on the sensitive detection of thermal gradient adjacent to the heated sample surface. A complete theoretical treatment of the PDS technique is presented which includes:1-The solution of the heat diffusion equation in the sample and the sur-rounding media using the incident beam as the source term for theheat diffusion equation.2-The temperature distribution in the collinear and transverse configura-tion.3-The corresponding deflection of the probe beam due to the gradient of the index of refraction for both collinear and transverse methods.The experimental setup of the transverse PDS has been extensively described including the position detector which converts the deflection of the probe beam into an output voltage.The experimental results show that there is an exponential decay in the PDS signal with increasing the chopper frequency, as well as an increase of phase difference with increasing the chopper frequency. The PDS -signal decreases with increasing the probe beam normal offset to allow us to calcu late the thermal diffusion length of the deflection medium (air in our case). We determined the thermal diffusion of the air to be = 0.43 mm at chopper— iv —frequency 50 Hz, which is in agreement with the published values. Further-more, we employed the PDS technique to obtain the spectra for two dye materials [Rhodamine 6G (Rh6G) and Crystal Violet (CV)] of different opti-cal absorption structure, the first sample with a single peak but the second with two overlapping peaks. The PDS shows a good resolution of the peaks of CV which are hardly separated in optical absorption measurements.Finally photoacoustic spectra for the same two dyes were carried out and a comparison with PDS was made which shows that though there is a cor-respondence between the two methods, the PDS has better spacial spectral resolution.