Research and Analysis on Optoacoustic Phenomenon

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This research is about a phenomenon where a half-black-painted glass bottle will make a sound when certain optical pulse reaches it. Firstly, different variables such as paint type, bottle size, bulb power, hole size, cap material and illumination type are changed in the experiment to illustrate the existence of the phenomenon and to find the key factor——the illumination type to the phenomenon simultaneously. Then, with this key factor, the reasons of this phenomenon are given from the perspectives of Fourier Series, forced oscillation and optoacoustic effect accordingly. What is more, a preliminary verification is done with chopper, digital oscilloscope, filter, stroboscopic light, high-precision decibel meter and a spectrum analyze application. Besides illumination type, other factors can also influence the phenomenon in experiment. This research gives an analysis of it in the end. We draw the following conclusion: when the coefficient n of SHG (second harmonic generation) is as small as possible and the pulse width equals half the period of the standing wave, the stimulus of the light pulse is most efficient, which means the amplitude of the sound wave is the biggest. We’d like to do some further research on how other variations, such as light intensity, influence the phenomenon.

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