Influence of the protective layer on the photoacoustic response of transparent samples

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In the transmision photoacoustic measurements of transparent samples, using minimum volume cell configuration, a thin protective layer is applied on one surface of the examined samples in order to protect the microphone. The influence of this layer on the recorded photoacoustic response is examined. In this paper, the models of photoacoustic (PA) response for transmission PA setup configurations of two-layered optically transparent samples with thermal memory are analyzed. When the protective layer is illuminated, its influence is significant at high modulation frequencies of the front surface temperature variations. When the layer is not illuminated, its influence is lost on the front side, but appears on the back side. It is shown that the protective layer has to be considered in the analysis of the recorded signal.

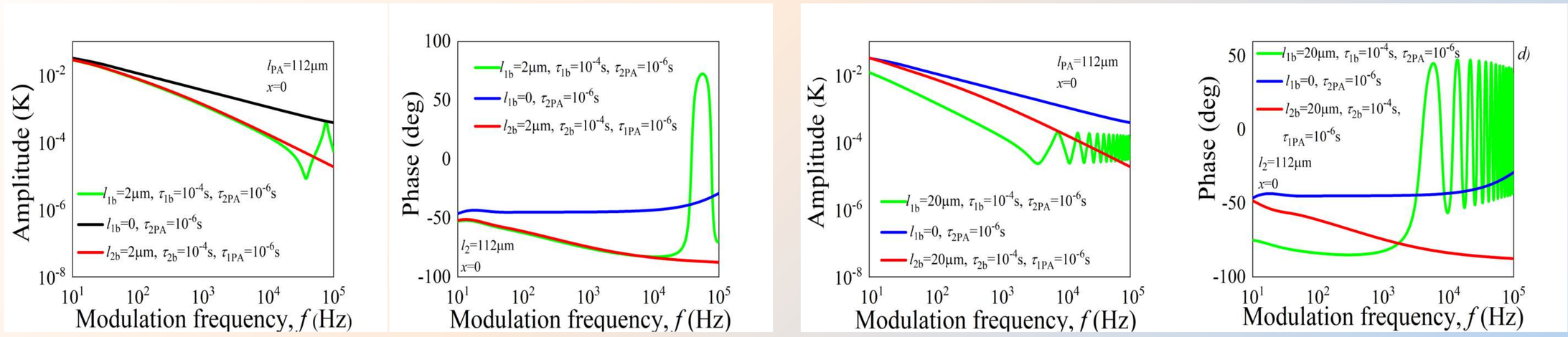
The amplitude and phase characteristics of the surface temperature variations of the two-layer structure where one layer is investigated layer PA12 and the other is protective layer (black dye) are presented at the following figures. The sample layer has got constant thickness (112μm) and the protective layer has got the following thickness values: 2μm and 20μm. The influence of the thermal memory of the investigated layer (PA12) is presented, too

The amplitude and phase characteristics of the surface temperature variations on the front side

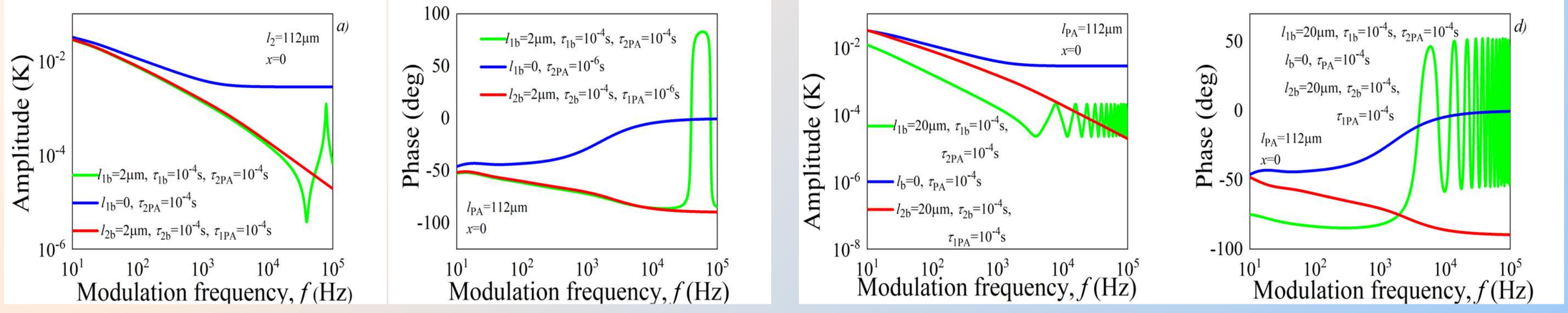
l_b=2μm - dye layer thickness

l_b=20μm - dye layer thickness

$\tau_{PA}=10^{-6}$s
Thermal relaxation time of the PA12



$\tau_{PA}=10^{-4}$s
Thermal relaxation time of the PA12

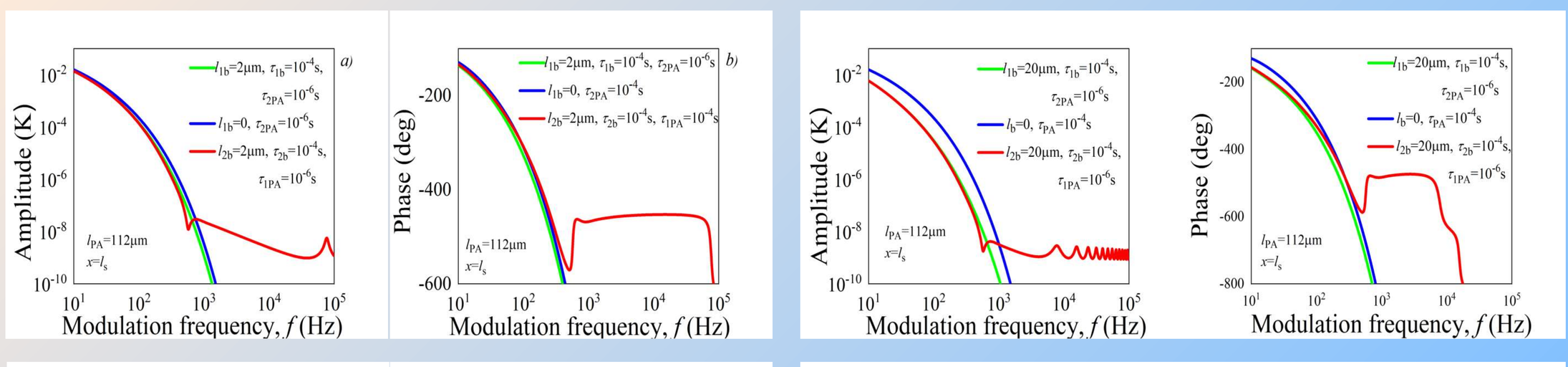


The amplitude and phase characteristics of the surface temperature variations on the back side

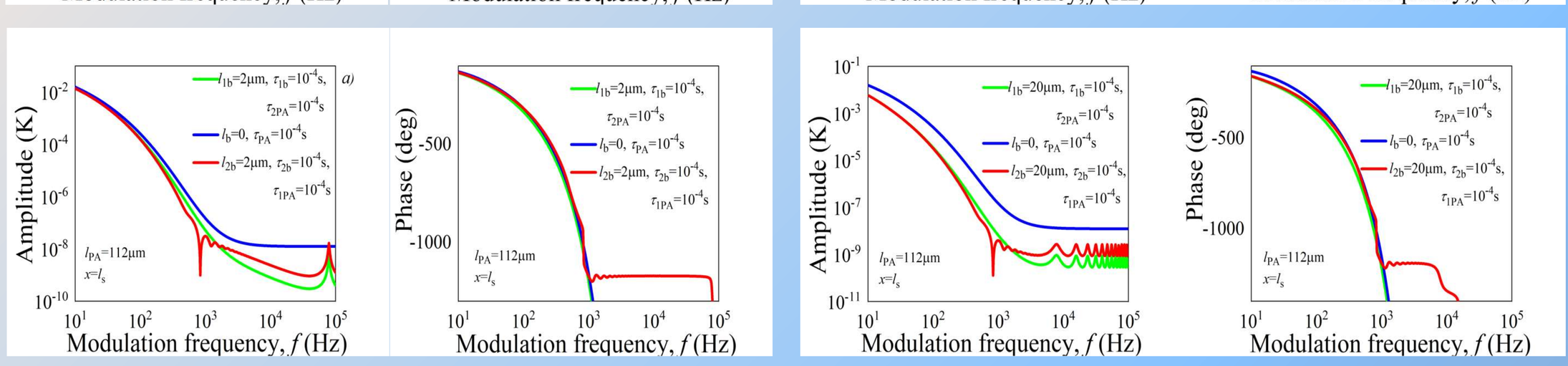
l_b=2μm - dye layer thickness

l_b=20μm - dye layer thickness

$\tau_{PA}=10^{-6}$s
Thermal relaxation time of the PA12



$\tau_{PA}=10^{-4}$s
Thermal relaxation time of the PA12



Main references

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