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Study of thermal diffusivity coefficient of ultrathin metal layers using thermal lens spectroscopy

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Abstract

In spite of the incredible evolutions of advanced material characterization methods, this field of research faces different technical and scientific challenges. Thermal lens spectroscopy is known as a sensitive and nondestructive optical based technique to characterize the opto-thermal properties of materials and also to diagnose the impurities in the solutions. In this research, by engaging thermal lens spectroscopy, we investigate the thermal diffusivity coefficient of ultrathin silver layers, prepared by magnetron sputtering. For this propose, the Shen theoretical model is fitted to the obtained empirical signal and subsequently, the thermal diffusivity coefficient will be extracted. The results clearly show that, in the investigated interval thickness (<15nm), the thermal diffusivity coefficient increases by increasing the thickness. Furthermore, our findings reveal that in the very fine thickness region, the thermal diffusivity coefficient shows a fair dependence on the thickness of the silver layers. This might be explained by 2D behavior of the thermal diffusivity for ultrathin metal nanolayers.

Keywords: ultra-thin layers of silver, thermal lens spectroscopy, thermal diffusivity

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