Breaking news

Thickness oscillation effect in photoexpansion and photocontraction of amorphous selenium

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The photo-induced expansion of amorphous selenium films was measured in situ for the first time using optolectronic interference enhanced by image processing [1] (Fig. 1).

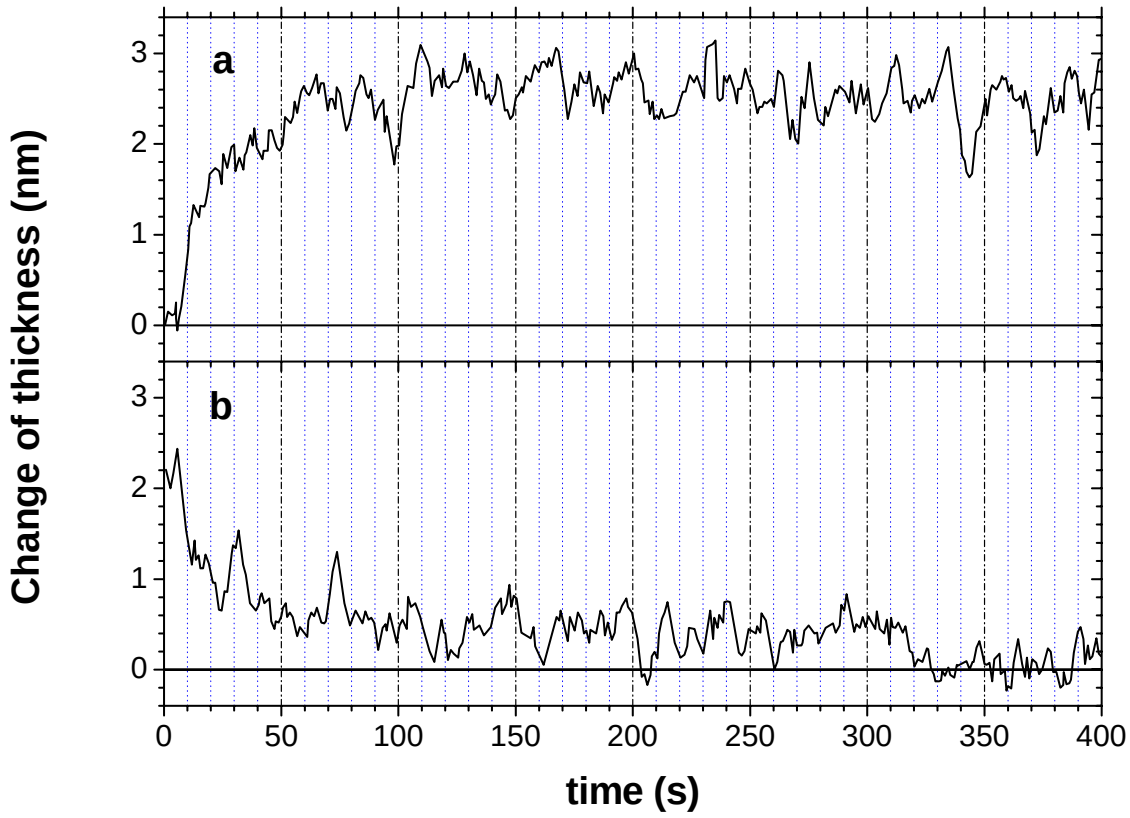

Fig. 1 Measured photoinduced changes in amorphous selenium. Upper panel: expansion due to illumination (a). Lower panel: shrinkage after switching off illumination.

We have processed the fundamental oscillation determined mainly by the noise.

In order to see if a special oscillation of thickness does exist, we have tried to separate the noise from a possible regular oscillation. To this aim we performed the Fourier transformation of the strings of data presented in Fig. 2 a and b. The results can be seen in Fig. 3.

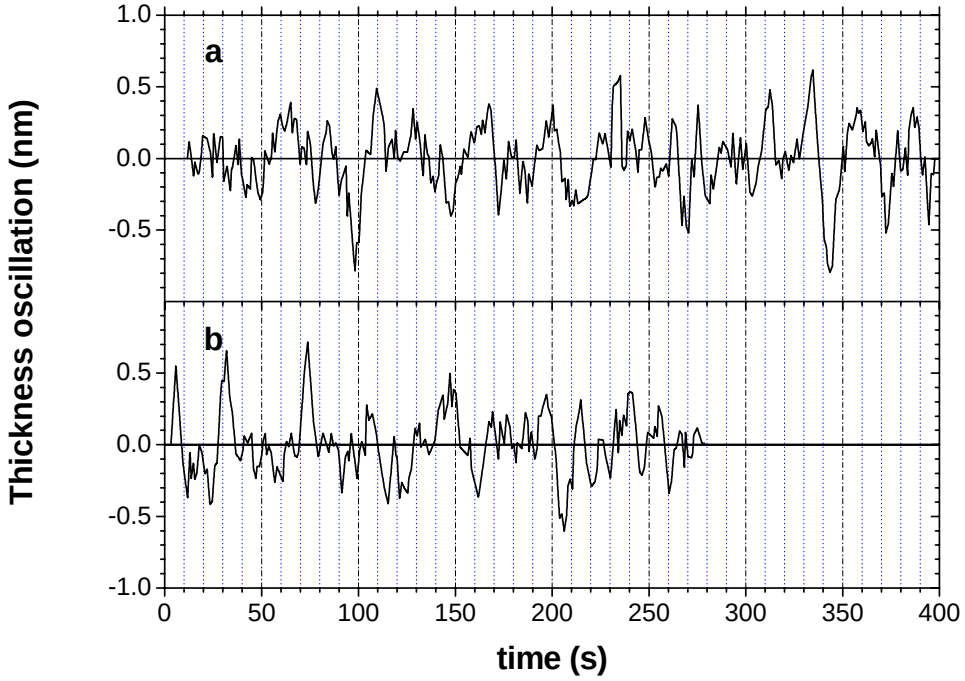

Fig. 2 The curves from figure 1 transformed by subtracting the average increase (a) and decrease (b).

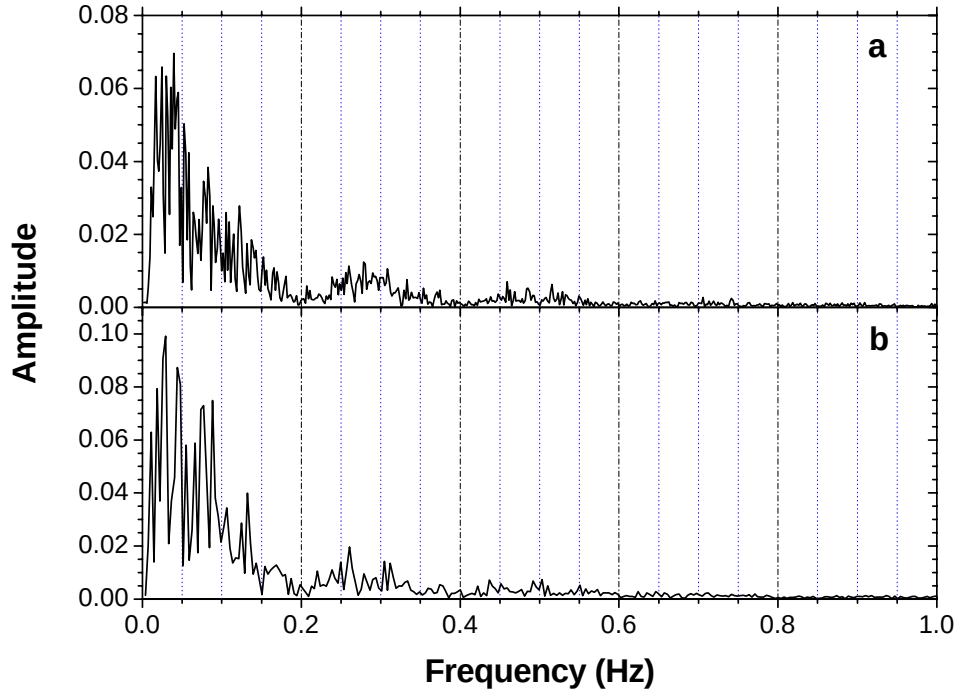

Fig. 3 Frequency spectrum for the data of figure 2.

By transforming the frequency spectrum into a period spectrum, we got period spectra that evidence oscillations of well-defined time-length situated at 41 s, 59 s, 88 s (Fig. 4a) and 36 s, 54 s, 91 s (Fig. 4b).

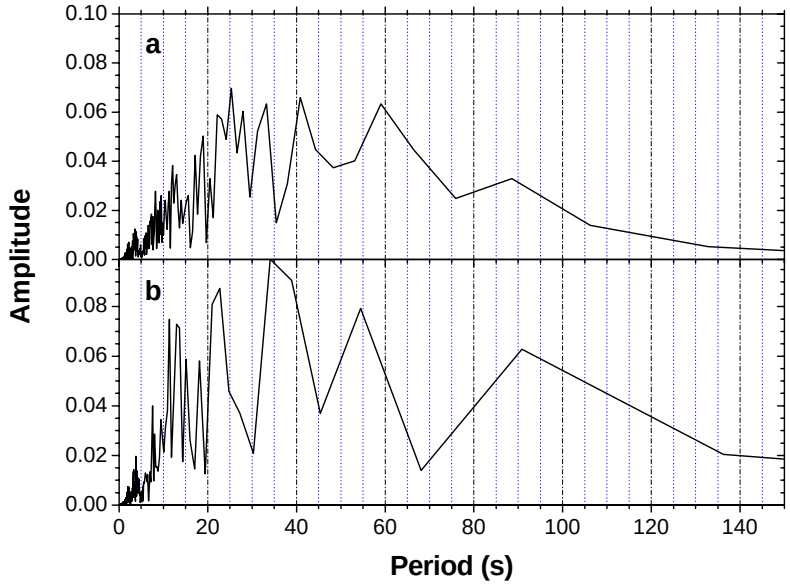

Fig. 4 The periods of the oscillations as obtained from the frequency spectrum.

In order to point out in the experimental data the existence of oscillations corresponding to the dominant period of 60 s we have applied a smoothing procedure by computer (Savitzky-Golay method). Figure 5 shows the results.

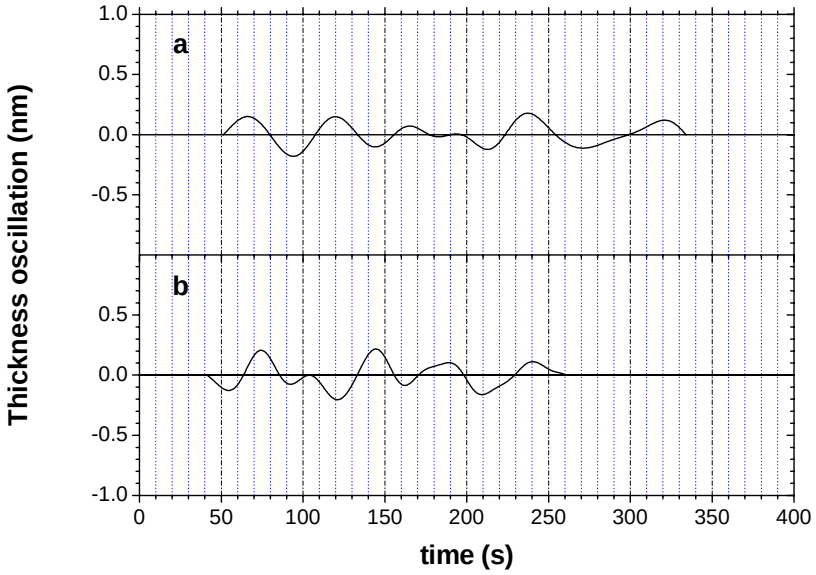

Fig. 5 The experimental data from figure 2, smoothed as to evidence the fundamental oscillations of the thickness

It is quite remarkable that both expansion and compression of the thickness of amorphous selenium film exhibit a dominant oscillation of well defined period: 60 s.

The mechanism and theory of this new phenomenon is under development.

References

[1] Y. Ikeda, K. Shimakawa, J. Non-Cryst. Solids, 338-340, 539 (2004).