Study of thin films obtained by pulsed laser deposition with a circular dichroism spectrometer

Jeremy ROUX

Introduction

The goal of this study was to check if a specific chiral organic molecule was degraded when sublimated by a laser. The PLD method (Pulsed Laser Deposition) was chosen because this method implies that a laser stroke the molecule before depositing it on a substrate. The thin film obtained is then analysed by circular dichroism (CD). In order to perform analyses a CD spectrometer assembled by the research team was used.

Experimental conditions

The homemade CD spectrometer consisted of a UV lamp (Newport model 69907) followed by a monochromator (Spectral product CM112) and a photoelastic modulator (PEM100 Hind Instruments) coupled with a lock-in amplifier (Standford research systems SR830) and a high-voltage system (Standford research systems PS325/2500V25W). The detector was a Photomultiplier (Hamatsu B2f/RFI). The laser used for PLD was a KrF (wavelength: 248 nm). Thin film depositions were done at various fluences : from 31 to 55 mJ/cm².

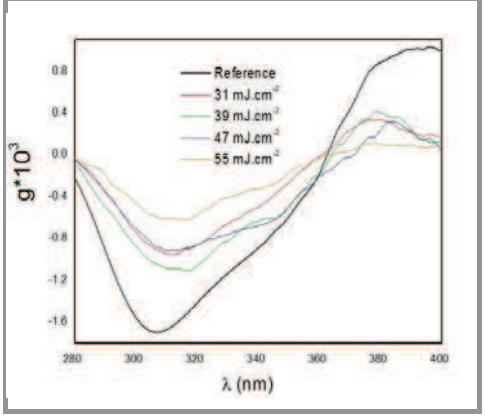
Results and discussions

The figure shown the g factor for various energies compared to a pure reference solution. The g-factor, defined as the ratio CD/Abs, quantifies the ratio of chiral molecules over the whole thin film. The solution used as a reference showed the g-factor for a non-degraded molecule. As shown by the figure 1 even at low energy the molecule appeared to be degraded by the laser since the g-factor decreased after thin film deposition. The greater the fluence, the higher the degradation. Moreover the study was restrained to fluences higher than 30 mJ/cm² because of a poor deposition rate. Indeed this organic molecule cannot be deposited with lower fluences. The exact nature of this degradation could be determined by chromatography or NMR analyses but it was not the goal of the study.

Conclusion

As a conclusion this study determined that this molecule is quickly and inevitably degraded when using the PLD method. Indeed, using fluences higher than 30 mJ/cm2 induced the degradation of this organic chiral molecule. Unfortunately this molecule cannot be deposited with lower fluence due to a poor deposition rate. Sublimating this molecule without any degradation was impossible with the PLD method: another method must be used.

Figure : g-factor for various thin films deposited at various fluences compared to the reference.



LPCML – UMR 5620 CNRS/UCBL
Domaine Scientifique de la Doua
Bâtiment Alfred Kastler
69622 Villeurbanne Cedex