On the mechanism of Non-Photochemical Laser Induced Nucleation
Melody Briard, Clément Brandel, Gérard Coquerel, Valerie Dupray

To cite this version:
Melody Briard, Clément Brandel, Gérard Coquerel, Valerie Dupray. On the mechanism of Non-Photochemical Laser Induced Nucleation. CRISTAL GROWTH OF ORGANIC MATERIALS - CGOM14, Sep 2022, Brussels, Belgium. hal-03777825

HAL Id: hal-03777825
https://normandie-univ.hal.science/hal-03777825
Submitted on 15 Sep 2022
ON THE MECHANISM OF NON-PHOTOCHEMICAL LASER INDUCED NUCLEATION

Mélody Briard1, Clément Brandel1, Gérard Coquerel1, Valérie Dupray1
1 Laboratoire SMS, UR 3233, Université de Rouen-Normandie, 76821 Mont Saint Aignan
melody.briard1@univ-rouen.fr

NPLIN = Non-Photochemical Laser Induced Nucleation

Nucleation process discovered by Garetz et al1 (1996)
NPLIN allows:
- A temporal control of nucleation (↘ induction time)
- An increase of the probability of nucleation
- A control of the number of crystals

What is the mechanism of this phenomenon?

Different hypotheses have been investigated through supersaturated aqueous solutions of K2SO4 or EDS

Cavitation, Optical Kerr Effect and nanoparticle heating

Can NPLIN be a stereoselective process?

Hypothesis: OKE (Optical Kerr Effect)
If an alignment of the dipoles along the electromagnetic field occurs
Then, laser polarization can influence NPLIN

Results: EDS β=1.10

Perspectives
Possibility to enhance the NPLIN effect by addition of particles.
For Diprophylline/ H2O β=3.25
Doping with Gold nanoparticles
-↘ Induction time
-↗ Probability of nucleation
Different particles concentration and nature have to be tested

Conclusions
Laser polarization geometry has no incidence on nucleation:
1) OKE mechanism is invalid for EDS
If there is Cavitation, bubbles might not be composed of gas
2) Hypothesis bubbles might be composed of solvent vapor

Nanoparticle heating seems the best hypothesis since presence or absence of particles has a strong influence on NPLIN behavior but it is not clear how particles are involved in the nucleation of the crystal (Hypothesis b, c or d from(4)).

References
(1) Garetz, B. A.; Aber, J. E.; Goddard, N. L.; Young, R. G.; Myerson, A. S. Physical review letters 1996, 77(16), 3475