Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics

Simultaneous two and three photon resonant enhancement of third-order NLO susceptibility in an azo-dye functionalized polymer film

ESI for communication in PCCP

Florica Adriana Jerca,[a,b] Valentin Victor Jerca,[a] Francois Kajzar,[c,d] Ana Maria Manea,[c] Ileana Rau,[c] and Dumitru Mircea Vuluga*[a]

[a] *Centre for Organic Chemistry Costin D. Nenitescu, Romanian Academy, 202B Spl. Independentei CP 35-108, 060023, Bucharest, Romania. Fax: 40213121601; Tel: 40213167900; E-mail: mircea.vuluga@gmail.com*
[b] *Ilie Murgulescu Institute of Physical Chemistry, Colloid Department, 202 Spl. Independentei CP 12-194, 060021, Bucharest, Romania.; E-mail: adriana_jerca@yahoo.com*
[c] *University "POLITEHNICA" of Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Street, 011061, Bucharest, Romania. E-mail: ileana_brandusa@yahoo.com*
[d] *Université d'Angers, Institut des Sciences et Technologies Moléculaires d'Angers, Bd Lavoisier, 49045, Angers, cedex, France. E-mail: frkajzar@yahoo.com*

Atomic force microscopy (AFM) characterization of the PMMA-M3 film

Instrument: MultiMode 8 Atomic Force Microscope (Bruker), equipped with a Nanoscope V controller, operated in tapping mode, using a cantilever length of 225 µm, with etched silicon tip (nominal radius 8 nm) and a resonance frequency of about 75 kHz. AFM measurements were performed at room temperature with a scan rate of 1 Hz.

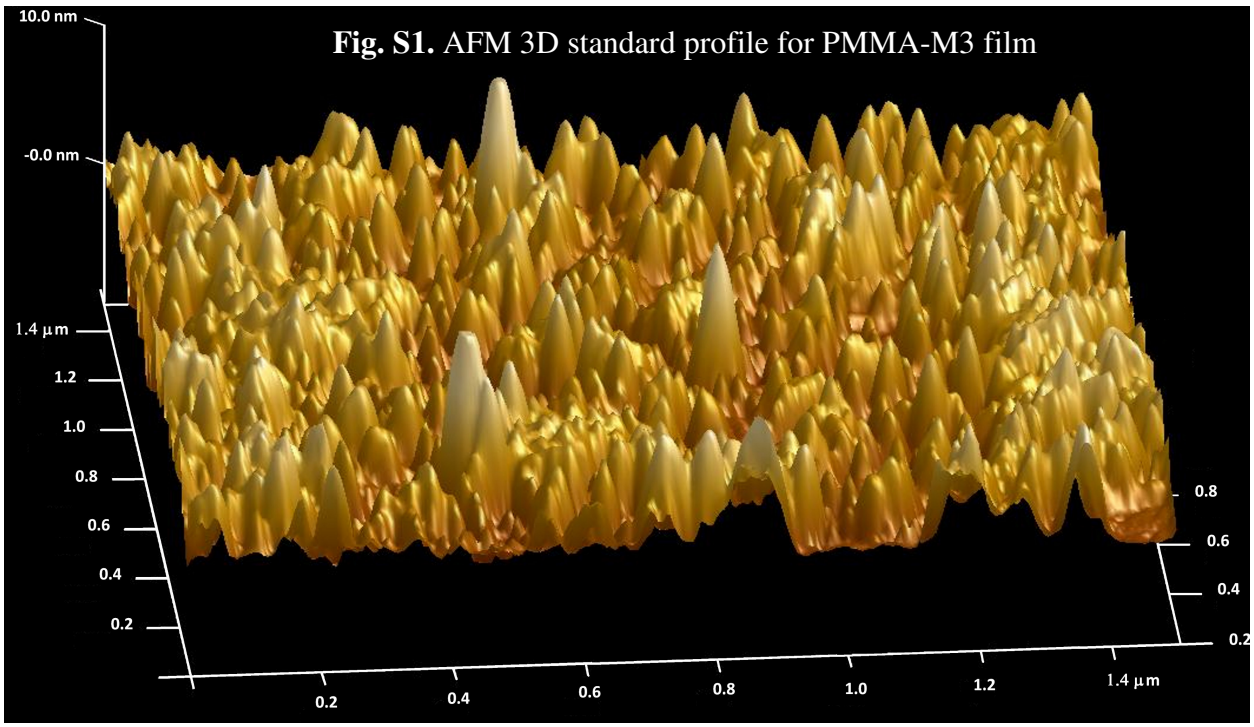


Fig. S1. AFM 3D standard profile for PMMA-M3 film

Results Roughness PMMA-M3		*Results Depth* PMMA-M3	
Image Z Range	13.8 nm	Peak to Peak Distance	1.076 nm
Image Surface Area	1.05 µm²	Minimum Peak Depth	9.088 nm
Image Projected Surface Area	1.04 µm²	Maximum Peak Depth	10.2 nm
Image Surface Area Difference	0.613 %	Depth at Histogram Maximum	10.16 nm
Image Rq	1.38 nm		
Image Ra	0.944 nm		
Image Rmax	13.8 nm		

*** ***Acknowledgment:*** authors are grateful to Dr Denis Mihaela PANAITESCU from ICECHIM-Bucharest, Romania (denisspan02@yahoo.com) for the AFM measurements.

Thermal Analysis of the PMMA-M3 polymer

Instrument:
NETZSCH STA 449C Jupiter system; simultaneous TGA-DSC was carried out from ambient temperature up to 700°C at a heating rate of 5°C/min under helium gas flow.

Characteristic values:

Glass transition temp.	T_g=148°C
Onset of degradation temp.	T_{on}=246°C
Temp. at 5% weight loss	$T_{5\%}$=271.5°C

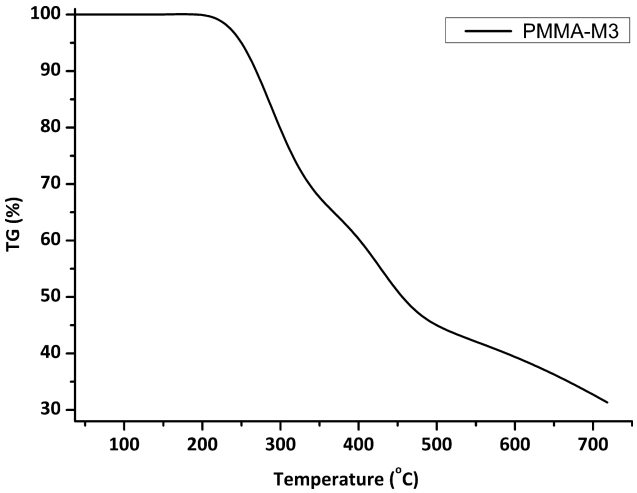
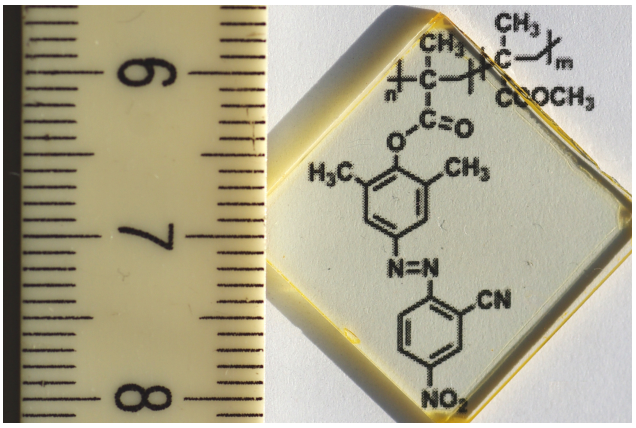


Fig. S2. Thermogravimetry curve of PMMA-M3

Optical transparency of the PMMA-M3 film



The optical photography reveals the good quality of the film, the paper roughness and printer fading can be seen with equal sharpness directly and through the film

Fig. S3. Optical photography of the PMMA-M3 film

Optical bench for THG measurements

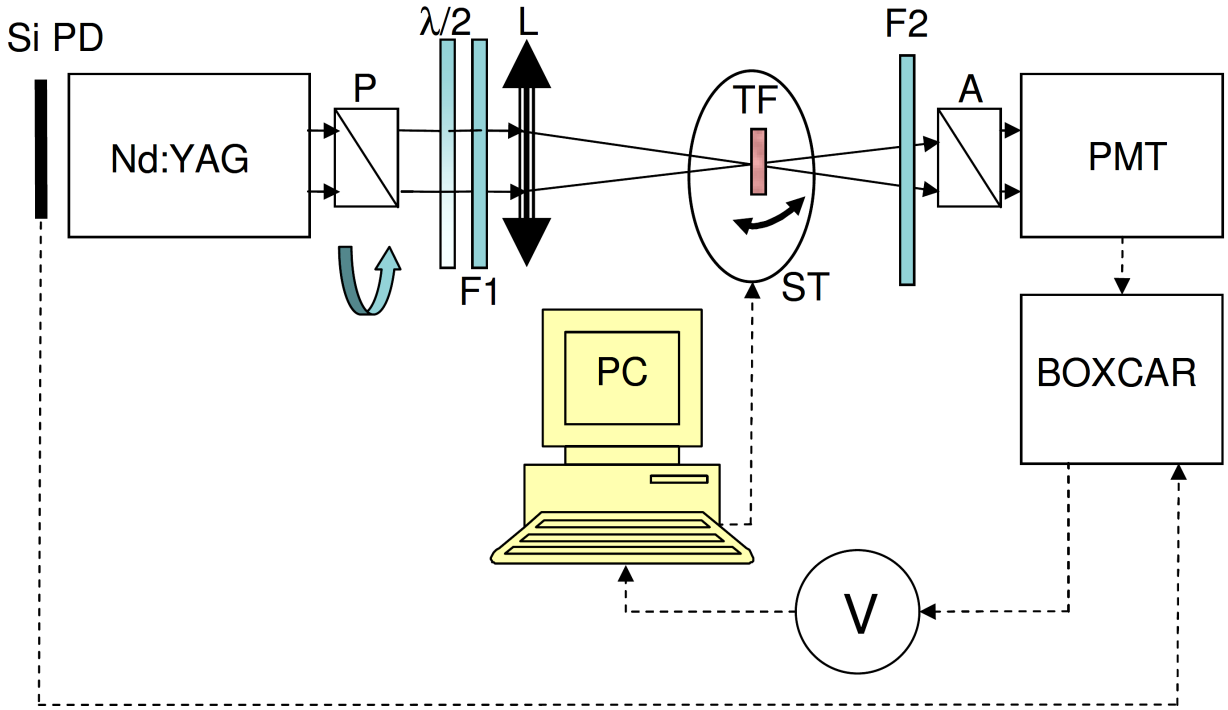


Fig. S4. Experimental setup used for THG measurements: ***Nd:YAG*** - 1064.2 nm pulsed laser; ***P*** - polarizer for checking polarization of fundamental beam; ***λ/2*** - half wave plate; ***F1*** - attenuation filters; ***L*** - converging lens; ***TF*** - studied film; ***ST*** - computer controlled rotating sample stage; ***F2*** - 3rd harmonic filters: 355 nm narrow pass interference filter and 1064.2 nm cutting filter; ***A*** - analyzer for harmonic beam; ***PMT*** - photomultiplier tube; ***BOXCAR*** - triggered amplifier; ***V*** - digital voltmeter; ***Si PD*** - fast Si photodiode for laser power control and signal triggering; ***PC*** - computer for system control and data recording.

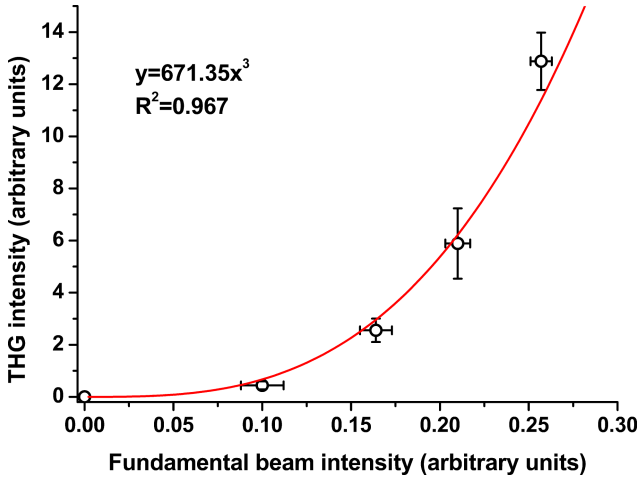
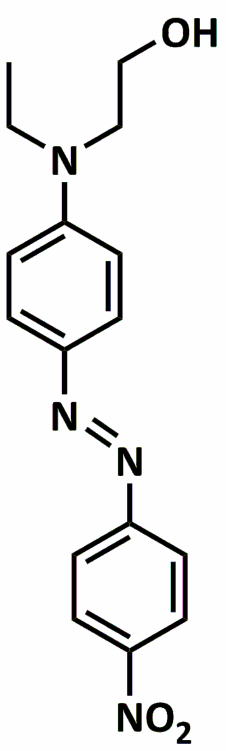


Fig. S5. THG intensity dependence on excitation power

Fig.S6. Chemical formula for the reference dye - the Disperse Red 1



N-Ethyl-N-(2-hydroxyethyl)-4-(4'-nitrophenylazo) aniline