Effect of Neutral-to-Acceptor Substituents Replacement on Self-Action Nonlinear Response Under Picosecond Laser Excitation

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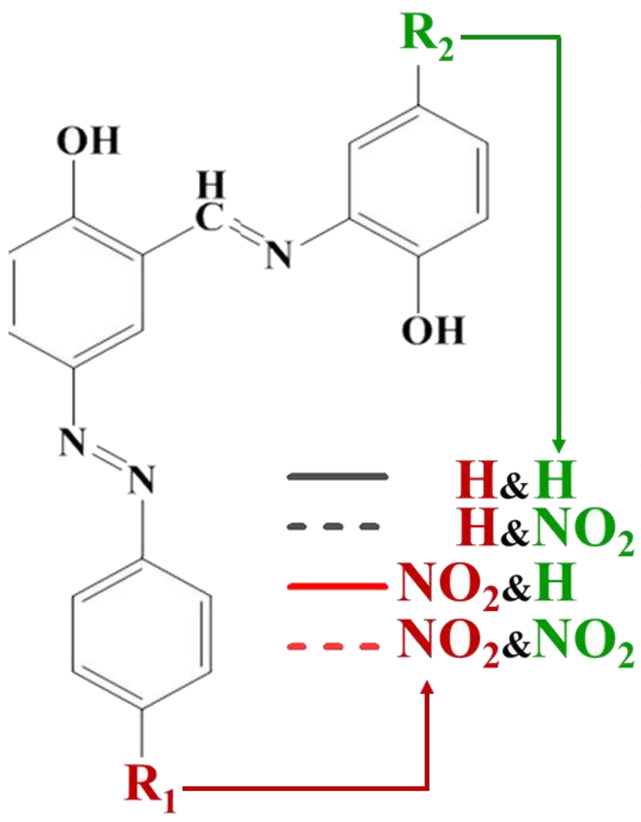
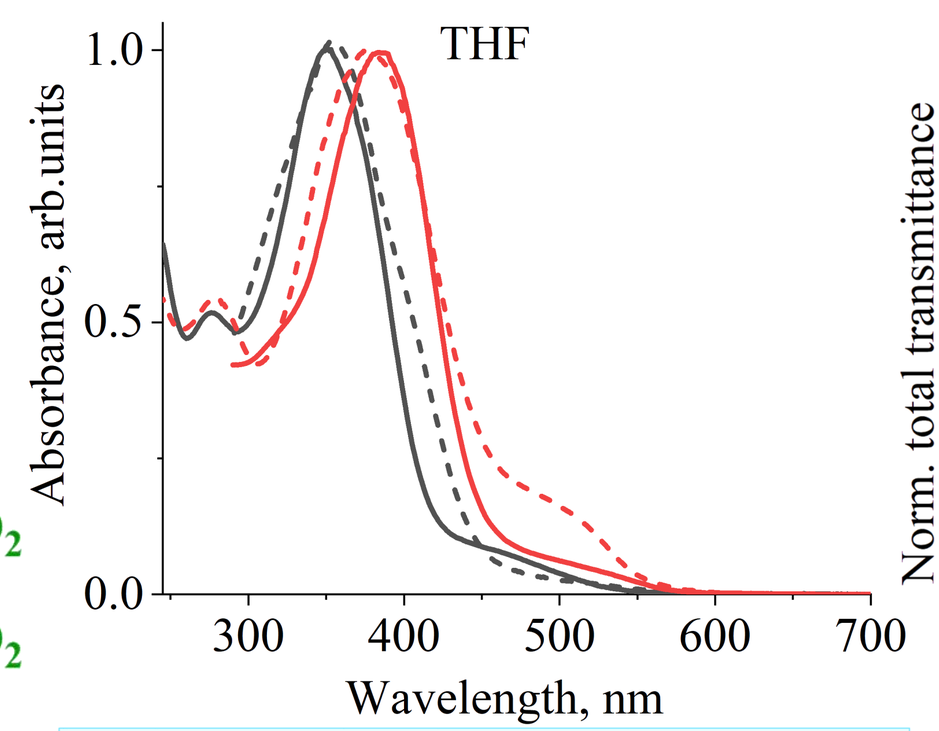
Polymers with π-conjugated electron system, like azobenzene or azomethine, represent a promising class of nonlinear optical (NLO) polymers, being widely recognized as candidates for many practical applications such as data storage, photoswitchable sensors, holographic recording, optoelectronic devices, etc. [1]. Impact of two several photoactive groups' joint contribution on NLO properties of polymers was not properly investigated yet.

In the presented study we have investigated self-action effects manifestation and neutral/acceptor substituents influences in PMMA thin films doped with 1% (wt.) of azo-azomethines within picosecond range pulsed laser excitation at 1064 nm [2]. Aforementioned azo-azomethines were synthesized through standard azo-coupling procedure with further condensation between aldehyde containing azobenzenes and hydroxy-anilines.

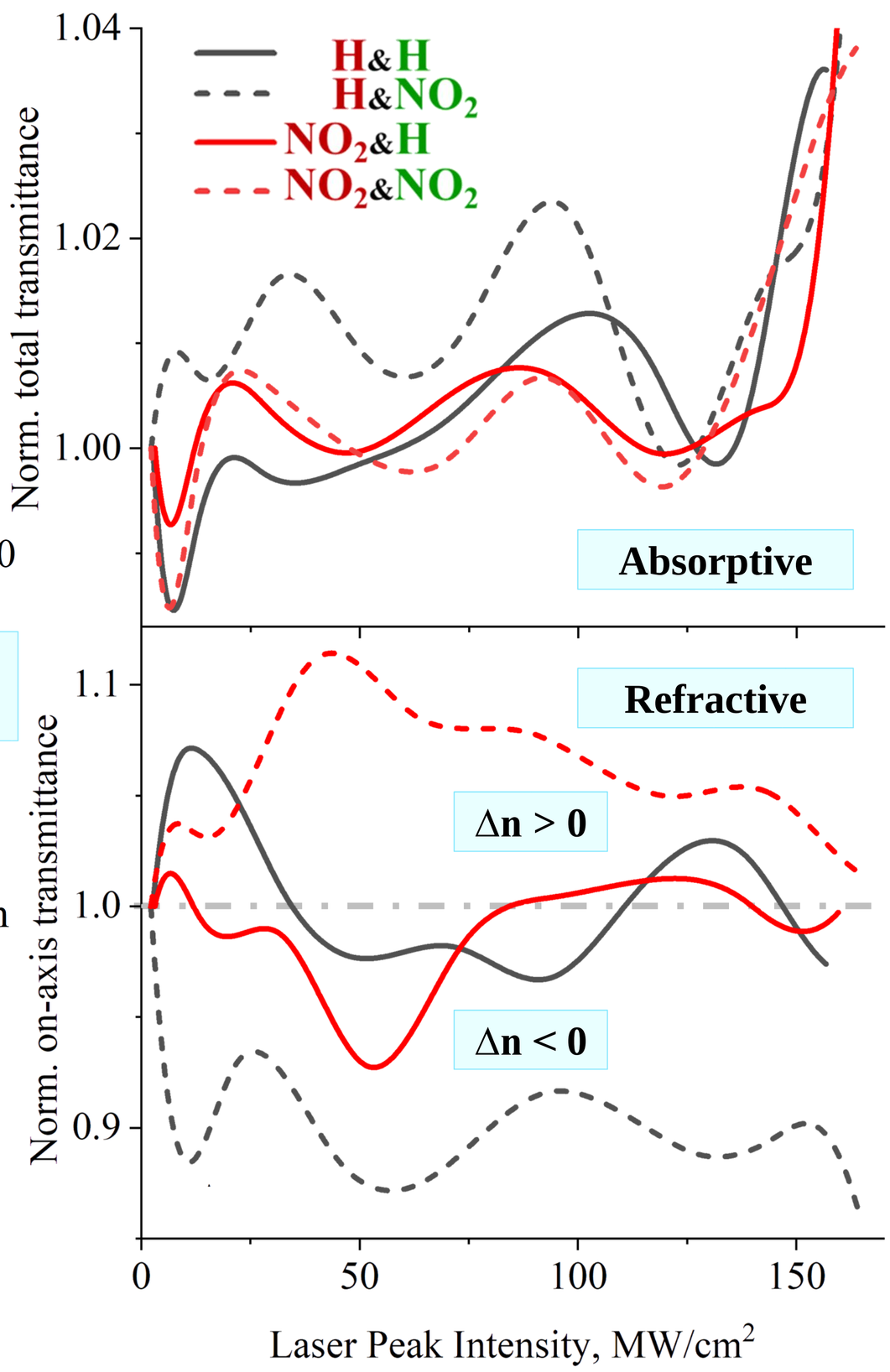
Samples under study



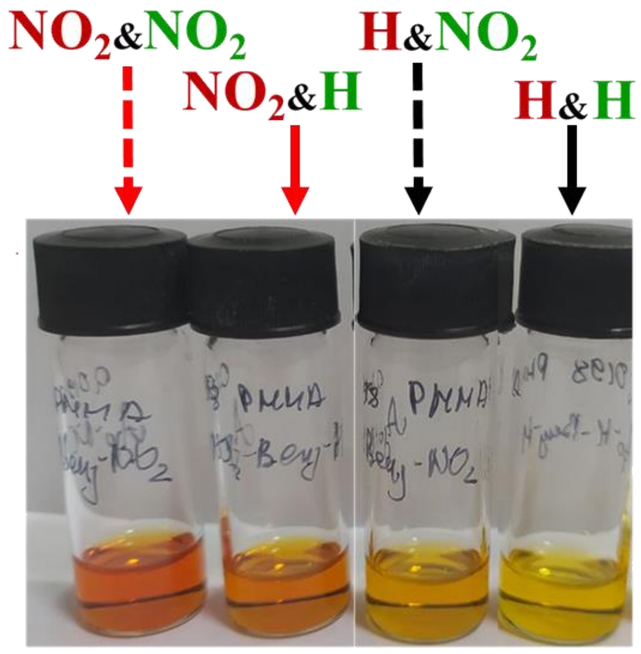
Absorbance spectra in THF solution

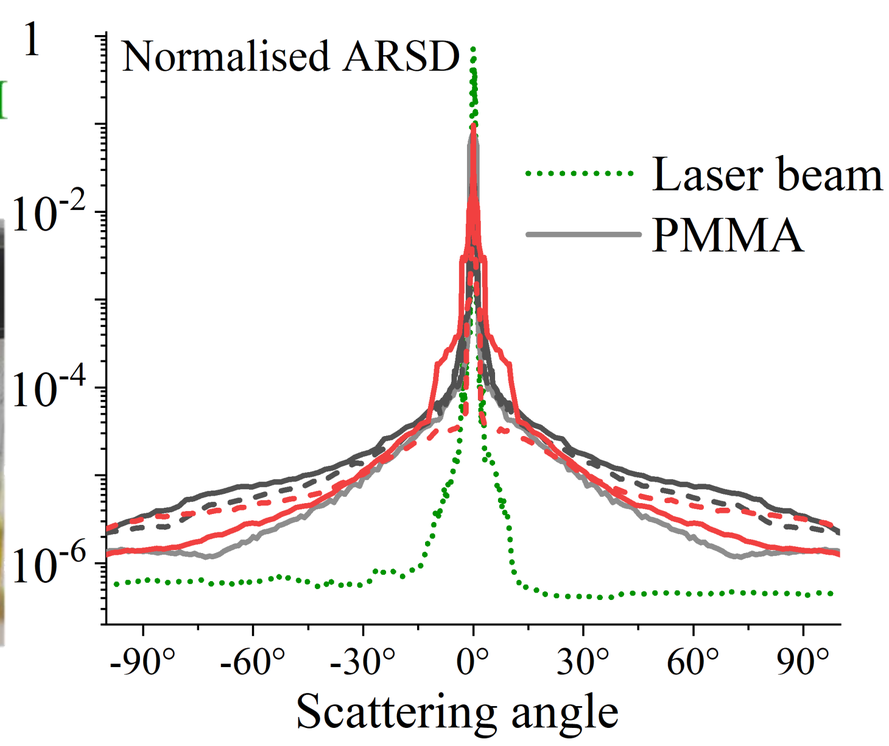


NLO Response @1064nm



Angularly resolved elastic scattering (ARSD) data @532nm





References: **1.** *Ovdenko V., Multian V.* et al., J.Mater.Chem.C. **8** (2020) P. 9032–9045. ***https://doi.org/10.1039/D0TC01657H***

2. *Ilchenko S., Multian V.* et al. Micromachines **12(1)** (2021) P. 41. ***https://doi.org/10.3390/mi12010041***

Conclusions. Novel polymer materials with π-conjugated electron system were synthesized and studied under pulsed picosecond range laser excitation ***@1064nm.*** It was shown that:

1) Efficiency $|Re(\chi^{(3)})| \sim 10^{-8}$ esu of the refractive NLO response for unsubstituted ***H&H and H&NO₂*** dyes are two times higher than for corresponding **(*NO₂&H and NO₂&NO₂*)** nitro analogues.

2) Replacement of a neutral ***H*** substituent (R_1) with an electron-acceptor ***NO₂*** one promotes switching sign of the NLO refractive response.

3) Obtained results are promising for design of efficient NLO nanocomposite materials with opposite signs of the refractive response.