DOCTORAL THESIS

Multi-photon excitation of organic complexes

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Multi-Photon Excitation of

Organic Complexes

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Abstract

Multi-photon up-conversion excitations of 4 novel organic complexes series have been investigated. The first two series of diphenylamino-endcapped oligofluorenes namely, PhN-OF(n)-TAZ where n = 2 – 5 and PhN-OF(n)-TAZ-OF(n)-PhN where n = 1 – 4 which contains with an electron withdrawing 1,2,4 triazole moiety as central core, the constituting D- π-A and D- π-A- π-D respectively. The next two series are also diphenylamino-endcapped oligofluorenes basis, the constituting D- π -D, which contains dibutyl (Bu) and diphenyl (Ph) substituent to form Bu-OF(n)-PhN and PhN-OF(n)-PhN where n = 2 - 5 respectively. It not only showed two-photon absorption of (PhN) substitients (2559GM) more strongly than (Bu) substitents (211GM) but also that they showed very strong three-photon excitation with blue photolumescence around 445nm when were pumped by 1.3μm wavelength. The important note is that the two PL spectra have only a small red shift of no more than 1-2nm. From the molecular geometry, the OF series have a non-coplanar structure. The longer conjugation length will have higher probability for them to twist together. The actual length was kept unchanged. Thus, it does not change the energy gap. Besides, it is find that D-π-D and D- π -A- π -D exhibit larger three-photon absorption properties than D-π-A moiety with the highest three-photon absorption cross-section at optimum wavelength NPh-OF(4)-TAZ-OF(4)-NPh $\sigma^{(3)}$ = $2.72 \times 10^{-77} cm^6 s^2$ at 1270nm. Among the three series organic complexes that are based on OF(n) conjugation, there are only two sets of PhN-OF(n)-TAZ and PhN-OF(n)-PhN exhibit multi-photon cavity-less up-conversion lasing, and it is in deep blue color region (445nm) by Kerr's effect which induced optical confinement for lasing. The full width half maximum of lasing spectrum is 7.35nm. There is almost 6 times narrower than PL spectrum with efficiency of up to 0.0627%. Finally, the oligofluorene OF(n) basis possess large value of two and three-photon absorption cross –sections with deep blue PL and lasing emission. The organic complexes can be applied as indicator or optical limiting material.

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