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Effects of surfactant concentration in carbon nanotube polymer composite for ultrafast fibre laser

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Saturable absorbers (SAs) based on nonlinear optical absorption plays a key role in achieving ultrashort laser pulses in a fibre laser system. Among these, carbon nanotubes (CNTs) based SAs serves as an excellent candidate to ensure stable mode-locking. Numerous approaches using CNT have been developed to enhance the nonlinear interaction, maintaining the all-fibre configuration. For example, a hollow core1 or D-shaped fibres2 can be employed. However, these methods expand the laser system, increasing the final cost, or reduce the integrity of the all-fibre structure. CNT polymer composite fabricated from effective dispersion of CNT in solvent offers a very convenient approach3. Usually, the CNT powder is mixed with surfactant and dispersed in water followed by ultrasonication and centrifugation. After centrifugation, the resultant solution is mixed with polymer and poured in the Petri dish to obtain the CNT polymer composite via drying the sample in the desiccator.

During the CNT SA preparation procedure, the ratio between CNTs powder and surfactant is critical which would help efficient dispersion of CNT in solvent preventing agglomeration in the later steps. However, there has no report so far on the effect of surfactant concentration in CNTs polymer composite on an ultrafast fibre laser performance.

In order to study this effect, we have produced set of CNT polymer composites with 0.2% CNTs and different surfactant concentration. The samples thus obtained were characterized by optical microscopy, and applied in an Erbium doped ultrafast fibre laser system.

Based on the results obtained, we can conclude that all samples ensure comparable generation of 700-fs pulses with the average power of 17mW at 200mW pump power. Though, samples with 0.5% and 1% surfactant demonstrate only partial mode-locking, whereas the sample with 2% surfactant maintains stable (for 24hours) ultrashort pulse generation even at remarkable high output power of 50mW.

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Biography:

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