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Thermal and nonlinear optical performances of a new fluid of isatin–oxadiazole hybrid: synthesis and experimental approach

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ABSTRACT

This work is aimed to identify a new organic hybrid that exhibits both nonlinear optical (NLO) and thermal performances. Hence, an efficient and scalable method is established for a cyclization reaction to afford valuable isatin–oxadiazole hybrid (**IOH**), namely, 3′-acetyl-5′-aryl-3-*H*-spiro[indoline-3,2′-[1,3,4]oxadiazol]-2-one ($C_{17}H_{13}N_3O_3$). The structural representation of **IOH** is elucidated utilizing various spectral techniques such as NMR, 2D NMR, FT-IR, HRMS, and UV–vis. spectroscopies. After experimental optimizations of **IOH**, the efficiency of the thermal and NLO properties is evaluated. The thermal conductivity (K), viscosity (η), specific heat (c_p), the refractive index change (Δn), nonlinear refractive index (NLRI), n_2, and all-optical switching (AOS) employing the controlling beam (473 nm) and the controlled beams (532 and 635 nm) are investigated. AOS parameters in terms of static and dynamic systems are also studied. By applying the Fresnel–Kirchhoff integral supplemented with the Fraunhofer function approximation, the experimental findings of diffraction patterns (DPs) are numerically estimated. necessary. that the names of the authors and their affiliations are

1 Introduction

Organic compounds comprising a heterocyclic system are considered as a fascinating scope in biological and material sciences [1]. In the heterocyclic compounds containing a D-π-A system, intra-molecular charge transfer (ICT) phenomenon occurs between two parts involving an electron-affluent part (donor) and electron-deficient part (acceptor) [2]. This phenomenon in such heterocyclic systems acts to enhance charge distribution through π-conjugated bridges and leads to large nonlinear optical (NLO) response [3, 4]. To acquire the effective NLO capability in the heterocyclic systems (push–pull structure), these systems should have a planar geometry to obtain good π-electron conjugation and their components (chromophores) should possess a centric polarity to provide a high dipole moment throughout their architectures [5, 6]. The production of diffraction patterns (DPs) is considered as an essential process in determining the NLO efficiency

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