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Mid-Infrared Photothermal Response in a Liquid Crystal Using a Quantum Cascade Laser[1] ALKET MERTIRI, Dept. Material Science, Boston University, MI HONG, Dept. Physics, Boston University, JEROME MERTZ, Dept. Biomedical Eng., Boston University, HATICE ALTUG, Dept. Electrical Eng.,Boston University, SHYAMSUNDER ERRAMILLI, Dept. Physics, Boston University — We report on a new technique to measure the mid-infrared photothermal response induced by a tunable Quantum Cascade Laser (QCL) in the neat liquid crystal 4-Octyl-4'-Cyanobiphenyl (8CB), without using any intercalated dye. The modulated pump QCL range spanned a weak combination absorption band centered at $1912cm^{-1}$. The thermally induced modulation of a Ti:Sapphire probe laser operating at 800 nm was measured by lockin detection. Heterodyne measurement of the response in the solid, smectic, nematic(N) and isotropic(I) liquid crystal phases allows direct detection of a weak mid-infrared normal combination mode absorption using an inexpensive room temperature silicon photodetector. The sensitivity of the response exceeds that of a conventional FTIR spectrometer equipped with a liquid nitrogen cooled detector. At high pump power in the nematic phase close to the N-I phase transition, we observe an interesting peak splitting in the photothermal response. The advent of tunable lasers that can access still stronger modes suggests that the photothermal mid-infrared response has the potential to detect ultralow concentration of absorbers.

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