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Photothermal Mid-Infrared Microscopy: a new tool for hyperspectral chemical imaging ALKET MERTIRI, Division of Materials Science and Engineering, Boston University, MI HONG, Department of Physics, Boston University, MICHELLE SANDER, Department of Electrical and Computer Engineering, Boston University, SHYAMSUNDER ERRAMILLI, Department of Physics, Boston University — We describe a method for label free microscopy in the mid-infrared region of the electromagnetic spectrum based on the photothermal effect. A Quantum Cascade Laser (QCL) tuned to an infrared active vibrational molecular normal mode is used as the pump laser. A low-phase noise Erbium-doped fiber (EDF) laser (1.5μm) is used as the probe. We demonstrate the method using a patterned image target with liquid crystal 4-cyano-4'-octylbiphenyl (8CB) as the mid-infrared absorber. The QCL is tuned across the C-H scissoring band, with a peak absorption at 1607cm^{-1}. Absorption of the modulated pump beam results in a change in the dielectric function and the refractive index at the probe beam frequency. The resultant scatter of the probe is observed in heterodyne lock-in detection. The combination of heterodyne detection, high brightness mid-infrared QCLs and low-phase noise stable EDF lasers provides an ultra-sensitive method for obtaining mid-infrared microscope images using short-wavelength optical detectors, whose performance far exceeds those of cryogenically cooled broadband mid-infrared detectors. The method provides a powerful new tool for hyperspectral label-free mid-infrared imaging.

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