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Surface temperature measurement by optical self-interference of laser beam at the edge of a thermally sensitive thin film PHUONG ANH DO, MOHAMED TOUABIA, ALAIN HACHE, Universite de Moncton — Measurement of surface temperature is problematic when the thermal mass of the probe (e.g. thermocouple or thermometer) is large relative to that of the sampled volume (e.g. thin film). With the goal of reducing thermal mass error, we developed a method using thermal probes in the form of thin films with materials exhibiting large physical and optical changes with temperature. Using chitosan, a polymer, as test material, we show that thermal expansion and refractive index changes in the film are detectable optically with a laser beam. When half of the Gaussian-shaped beam travels through the edge of the film and half of it does not, self-interference in the form of a fringe pattern is observed in the far field. With the fringe displacement correlated to phase variations and temperature changes, the calibration can be used to probe surface temperature on other samples. With the laser beam focused to 50 μm and chitosan films as thin as 100 nm, the method is adequate to measure temperature in the near vicinity of the surface. We provide a theory and numerical simulations to determine the ideal experimental conditions and parameters.

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