Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Multi-variable calibration of temperature estimation in individual non-encapsulated thermo liquid crystal micro particles[1] RODRIGO SEGURA, CHRISTIAN CIERPKA, MASSIMILIANO ROSSI, CHRISTIAN J. KÄHLER, Institute for Fluid Mechanics and Aerodynamics Bundeswehr University Munich — An experimental method to track the temperature of individual non-encapsulated thermo-liquid crystal (TLC) particles is presented. TLC thermography has been investigated for several years but the low quality of individual TLC particles, as well as the methods used to relate their color to temperature, has prevented the development of a reliable approach to track their temperature individually. In order to overcome these challenges, a Shirasu Porous Glass (SPG) membrane approach was used to produce an emulsion of stable non-encapsulated TLC micro particles, with a narrower size distribution than that of encapsulated TLC solutions which are commercially available (Segura et al, Microfluid Nanofluid, 2012). On the other hand, a multi-variable calibration approach was used, as opposed to the well known temperature-hue relationship, using the three-components of the HSI color space measured in each particle image. A third degree three-dimensional polynomial was fitted to the color data of thousands of particles to estimate their temperature individually. The method is able to measure individual temperatures over a range exceeding the nominal range of the TLC material, with lower uncertainty than any method used for individual particle thermography reported in the literature.

[1]Financial support from the German Research Foundation (DFG), under the Forschergruppe 856 grant program, is gratefully appreciated.

Rodrigo Segura
Institute for Fluid Mechanics and
Aerodynamics Bundeswehr University Munich

Date submitted: 09 Aug 2012 Electronic form version 1.4