Mass transport in laser-heated semiconductor microwires

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We have been working with laser-induced recrystallization of semiconductor mixtures encapsulated inside micrometer-scale capillaries, using the apparatus shown in Fig 1.

The as-made fiber has small Ge-rich inclusions which melt at a lower temperature than the rest of the fiber. These appear as small droplets of liquid (identifiable due to their lower emissivity), within the green and blue circles in Fig 1(b) (see supplementary movie 3, http://rdcu.be/l0B9) in the presence of a temperature gradient. Droplets can be seen to be moving through a matrix of solid silicon towards the region of highest temperature. This is due to the higher solubility of silicon in the liquid at high temperatures. The temperature gradient causes silicon to dissolve at the leading edge (high temperature side) and precipitate out in the trailing edge, in a highly unusual form of flow.

This project will center on image analysis of videos to extract information about the temperature gradients, volume and velocity of the liquid phase, and simple modeling of the physics involved. A student with an interest in, and aptitude for, computer programming, and an interest in thermodynamics, is ideal for this position.

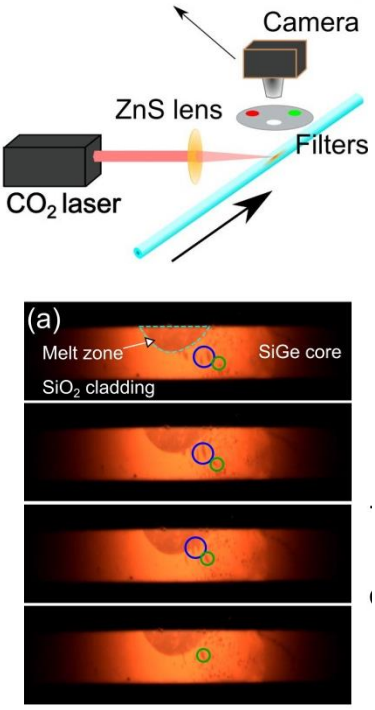

Fig 1 (a) laser annealing setup for SiGe core fibers, (b); image of Ge-rich liquid flowing in the core. (Nat. Comm. **7,** 13265 (2016)