Thermally controlled fluidic self-assembly

A novel approach for the fluidic self-assembly (FSA) of microparts in a multibatch process utilizing the thermal behavior of the carrier fluid as a means for selecting binding sites is presented. In the system studied, fluidic assembly takes place due to a capillary bridge between hexadecane deposited on a hydrophobic patch on a substrate and a hydrophobic surface on a micropart suspended in a carrier fluid. When desired, FSA of microparts is prevented by causing the surrounding carrier fluid to form a gel when heated, offering a method for directing self-assembly to sites that are not heated. It is shown that a suitable carrier fluid is 15 wt % Pluronic F127, which gels at about 40 degrees C when tested in the geometry used to demonstrate the concept. Experimental results demonstrating FSA and thermally controlled fluidic assembly (TCFSA) of plastic microparts dispersed in Pluronic F127 solution are presented. Potentially, TCFSA offers a general method for directed assembly as it relies on restricting the transport of microparts to a site rather than interfering with the fundamental attractive forces responsible for self-assembly.