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Modeling Patterned Substrates that Selectively Entrap and Burst Microcapsules ALEXANDER ALEXEEV, ANNA C. BALAZS, Department of Chemical Engineering, University of Pittsburgh, Pittsburgh, PA 15261 — To optimize the efficient operation of microfluidic devices, there is a need for micro-carriers that can be readily directed to specific locations within microchannels and made to release their contents in a prescribed manner. Compliant microcapsules constitute ideal micro-carriers since both their chemical and mechanical properties can be tailored, providing distinct keys for regulating their behavior. Using computational modeling, we lay out chemically patterned substrates that exploit these distinctive features and thereby selectively route specific capsules to specified locations, drive these capsules to burst and thus, deliver their payload in a "programmable" manner. The findings reveal that an "instruction set" can be encoded into the system by coupling the physicochemical properties of the microcapsules and the substrates. These instructions are dynamically deciphered during the operation of the device, so that the system can perform a number of functions in an autonomous manner. This approach opens up new strategies for designing smart microfluidic devices.

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