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Creating Reconfigurable Materials Using "Colonies" of Oscillating Polymer Gels DEBABRATA DEB, University of Pittsburgh, PRATYUSH DAYAL, Indian Institute of Technology Gandhinagar, OLGA KUKSENOK, ANNA C. BALAZS, University of Pittsburgh — Species ranging from single-cell organisms to social insects can undergo auto-chemotaxis, where the entities move towards a chemo-attractant that they themselves emit. This mode of signaling allows the organisms to form large-scale structures. Using computational modeling, we show that millimeter-sized polymer gels can display similar auto-chemotaxis. In particular, we demonstrate that gels undergoing the self-oscillating Belousov-Zhabotinsky (BZ) reaction not only respond to a chemical signal from the surrounding solution, but also emit this signal and thus, multiple gel pieces can spontaneously self-aggregate. We focus on the collective behavior of "colonies" of BZ gels and show that communication between the individual pieces critically depends on all the neighboring gels. We isolate the conditions at which the BZ gels can undergo a type of self-recombining: if a larger gel is cut into distinct pieces that are moved relatively far apart, then their auto-chemotactic behavior drives them to move and autonomously recombine into a structure resembling the original, uncut sample. These findings reveal that the BZ gels can be used as autonomously moving building blocks to construct multiple structures and thus, provide a new route for creating dynamically reconfigurable materials.

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