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Programmable Sequential Assembly in a DNA Functionalized Emulsion System YIN ZHANG, LEA-LAETITIA PONTANI, MARTIN HAASE, LANG FENG, Department of Physics, New York University, RUOJIE SHA, NADRIAN SEEMAN, Department of Chemistry, New York University, JASNA BRUJIC, PAUL CHAIKIN, Department of Physics, New York University — Assembling a complex structure requires not only the appropriate association of specific units, but putting the pieces together sequentially in the right order. We present the sequential self-assembly of a system of micron-sized emulsion droplets functionalized by pre-programmed DNA molecules. Each droplet is initially inert with the DNA protected by a partially complementary strand with a toehold. A Yurke process [1] utilizes the toehold to free the protected strand which can then act in a similar way to bind to the toehold on the next droplet in the sequence and deprotect a strand which continues the reaction to subsequent droplets. Since the DNA attached to a lipid on an emulsion is mobile this design enables the cyclic strand displacement on the nanoscale to produce sequence-specific interactions on the microscale. We demonstrate such programmed assembly in a system of three types of droplets with different cyclically complementary protected strands.

[1] B. Yurke et al., Nature, 406, 605-608(2000)

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