NANOHOUR

Wednesday, November 19, 2008
3:00 pm - Beckman Institute - Room 3269

DNA-directed Assembly of Colloidal Crystals

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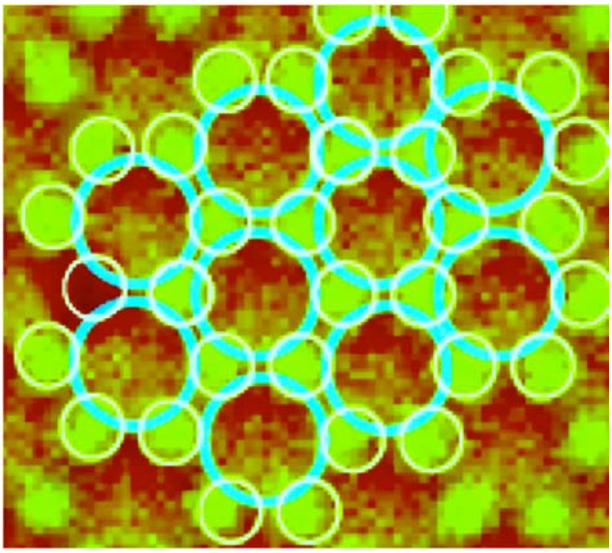

Among the numerous efforts to harness biological activity for controlling self-assembly of nano-and micro-structured materials, DNA-mediated assembly is of great interest, because DNA hybridization is well-studied and can be tailored by tuning the sequences, salt concentration, and assembly temperature. Many researchers have pursued the idea of tailoring the hybridization properties of DNA-functionalized colloids by in hopes of achieving such a structure. While self-assembly of FCC-colloidal crystals is quite commonplace, assembly of non-FCC structures is no small feat. We have used DNA and its unique biochemical reactivity to self-assemble non-FCC colloidal crystals. DNA hybridization provides an opportunity to exploit another biological activity of DNA: DNA ligase is a repair enzyme used to seal nicks in hybridized DNA.

We have demonstrated that ligase can augment DNA-mediated self-assembly to create novel colloidal structures. Simply, DNA is attached to a glass substrate, DNA-functionalized colloids are self-assembled onto the substrate, and the colloid-DNA and the substrate-DNA are hybridized by a “linker sequence”. Effectively the colloid-and substrate-tethered DNA are treated as a DNA sequence with a “nick,” which can be repaired by the ligase, resulting in colloids permanently tethered to substrates. Since the ligase does not act upon non-hybridized DNA, any DNA on the colloid (i.e. away from the substrate) will remain unaltered and be available to hybridize to a subsequent layer of particles. DNA ligation also provides a route towards assembling crystals of more than one material, such as silica and polystyrene crystals. Using this simple idea, we have assembled both non-FCC as well as silica-co-polystyrene crystals. For the first time, these stable and robust structures were imaged using confocal microscopy. This work represents a new paradigm for both DNA-directed self-assembly and general self-assembly.

Coffee, tea and cookies will be served.

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