

Colloidal joints with tunable joint stiffness assemble into reconfigurable structures

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Self-assembly of colloidal particles often suffers from kinetic trapping in undesirable states and typically does not allow for re-configurability in the final structure. We here show that colloidal particles with surface-mobile DNA linkers overcome these problems by forming strong, specific yet reconfigurable bonds. Depending upon their shapes, these DNA functionalized particles enable rotational, angular or constrained linear motion, essentially acting as colloidal joints. We can experimentally tune the effective joint stiffness by controlling the DNA linker density, colloid size, linker type and time. We utilize these colloidal joints to produce flexible structures including colloidal molecules, colloidal polymers and floppy networks. We observe an unexpected self-assembly pathway into novel crystalline structures, which arises as a direct consequence of the reconfigurability of the building blocks. Such flexible colloidal structures are promising materials for building switchable photonic crystals and colloidal metamaterials.

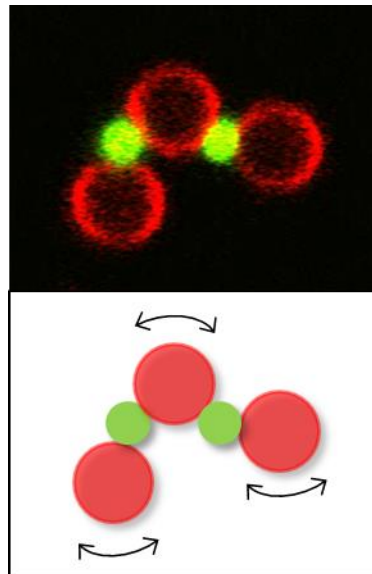


Figure 1 A floppy colloidal polymer composed of 2 μm and 1 μm silica particles with mobile DNA linkers (top) and a schematic diagram showing the reconfigurable nature of the colloidal polymer (bottom).