

Spontaneous Formation of Cadmium Hydroxide Nanostrands in Water

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We report herein cadmium hydroxide nanostrands with a diameter of 1.9 nm that are spontaneously formed by rising pH of a dilute Cd(NO₃)₂ solution. The length reaches a few micrometers and the aspect ratio exceeds one thousand. The crystallographic structure was successfully elucidated by high-resolution electron microscopy. The nanostrands were extremely charged positively, and adsorbed negatively charged organic molecules. For example, when the nanostrand was mixed with Evans Blue solution, blue-colored weakly-gelled precipitates were produced. From the UV-vis titration experiment, the composition of cadmium hydroxide nanostrand was determined to be [Cd₆(OH)₁₁(H₂O)]⁺. Similar hydroxide nanostrands were formed from lanthanide ions such as Gd³⁺, Eu³⁺, and Lu³⁺. TEM observation revealed that these lanthanides gave very flexible and amorphous nanostrands with a diameter of 2-4 nm.

Dimensions of cadmium hydroxide nanostrand are consistent with the size of 6-kbp double-strand DNA that has the length of 2 μm (1 bp = 0.34 nm) and the width of 2 nm. The hydroxide nanostrands with periodic electrostatic potential can strongly absorb rigid double-strand DNA chains electrostatically. Furthermore, the nanostrands quickly disappear by lowering pH or adding chelate compounds such as EDTA. Along these lines, we are developing an efficient system for trapping and releasing DNA in the dilute solution.

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