

Stability of DNA Origami Nanostructures to Functionalize Electrochemical Biosensors

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Introduction:

Probes can be immobilized on DNA origami to create sensitive biosensors. DNA origami, however, requires a high concentration of Mg^{2+} ions to solvate the negatively charged phosphate backbone and maintain structural integrity. Solutions used to functionalize the origami typically do not have such high concentrations or can have adverse interactions. Conserving the structure is essential to maintain the arrangement of the probes and chemical properties of the origami. The purpose of this experiment is to study the stability of 2D cross-shaped origami in three solutions used to functionalize electrochemical biosensors: 1 mM potassium ferricyanide, 5 mM potassium ferricyanide, and Kblue.

After construction, the 1X TAE 11.5 mM Mg^{2+} formation solution was switched with one of the three aforementioned solutions. Samples from one, three, five, and seven days were pulled and characterized by agarose gel electrophoresis (AGE) and atomic force microscopy (AFM).

Results:

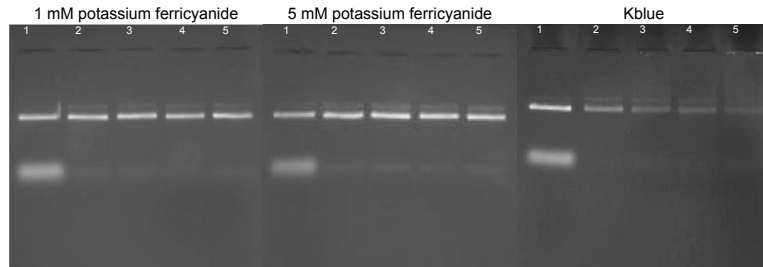


Figure 1 a-c are the agarose gels from 1 mM potassium ferricyanide, 5 mM potassium ferricyanide, and Kblue, respectively. Lane 1 is the M13 control, lane 2 is 1 day sample, lane 3 is 3 day sample, lane 4 is 5 day sample, and lane 5 is 7 day sample.

Results cont.

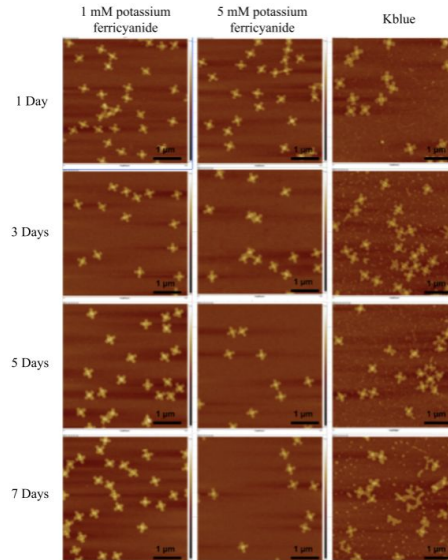


Figure II is the atomic force microscopy images for all three solutions and for days one, three, five, and seven. Each image has one μm x one μm dimensions.

Conclusions:

There was no degradation seen in the 1 mM potassium ferricyanide and 5 mM potassium ferricyanide agarose gels or in the AFM images up to a week. The Kblue gel showed a decrease in band intensity in the first sample lane. The Kblue AFM images show unclear backgrounds and distorted shapes in the first sample. These results demonstrate that origami is stable in 1 mM and 5 mM potassium ferricyanide up to a week, but the origami begins to degrade in the Kblue solution within the first 24 hours.