

Colorimetric Monitoring of the Dynamic Conformation Changes of DNA-Templated Gold Particle Dimers

Laurent Lermusiaux and Sébastien Bidault

ESPCI Paris, PSL Research University, CNRS, Institut Langevin, Paris, France

The nanometer-scale sensitivity of plasmon coupling allows the translation of minute morphological changes in nanostructures into macroscopic optical signals. In particular, single nanostructure scattering spectroscopy provides a direct estimation of interparticle distances in gold nanoparticle (AuNP) dimers linked by a short DNA double-strand [1].

We demonstrate here that this spectroscopic information can be inferred from simple widefield measurements on a calibrated color camera (Figure 1) [1]. This allows us to analyze the influence of electrostatic and steric interparticle interactions on the morphology of DNA-templated AuNP groupings. Furthermore, polarization-resolved measurements on a color CCD provide a parallel imaging of AuNP dimer orientations.

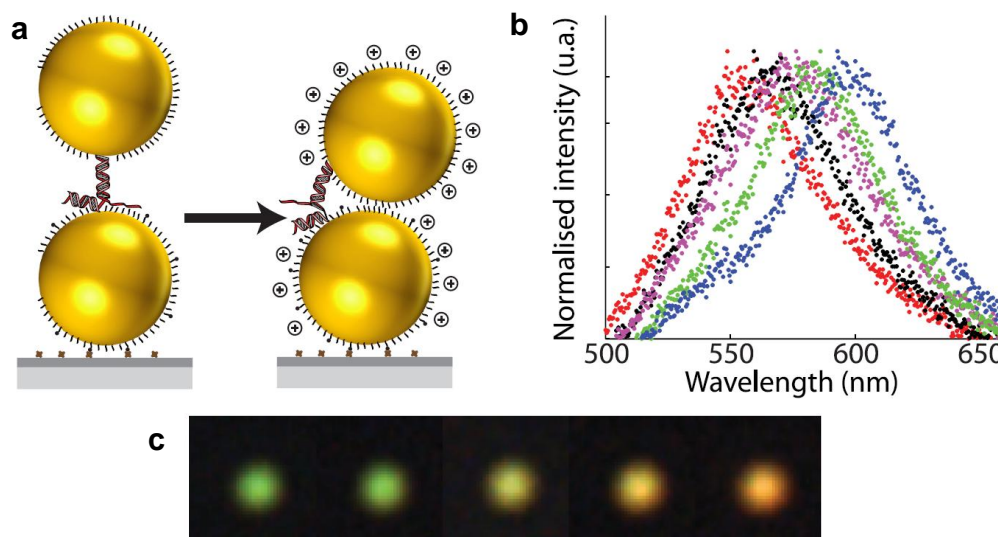


Figure 1: (a) Schematic representation of the distortion of AuNP dimers when modifying the ionic strength. Single nanostructure scattering spectroscopy (b) and color monitoring (c) for a single dimer at different salt concentrations.

We apply this spectroscopic characterization to identify dimers featuring two different conformations of the same DNA template. In practice, the biomolecular scaffold contains a hairpin-loop that opens after hybridization to a specific DNA sequence and increases the interparticle distance [2]. These results open exciting perspectives for the parallel sensing of single specific DNA strands using plasmon rulers. We discuss the limits of this approach in terms of the physicochemical stability and reactivity of these nanostructures and demonstrate the importance of engineering the AuNP surface chemistry, in particular using amphiphilic ligands [3].

1. Lermusiaux L., Maillard V., Bidault S., *Widefield Spectral Monitoring of Nanometer Distance Changes in DNA-Templated Plasmon Rulers*, ACS Nano 9, 978-990, 2015
2. Lermusiaux L., Sereda A., Portier B., Larquet E., Bidault S., *Reversible Switching of the Interparticle Distance in DNA Templated Gold Nanoparticle Dimers*, ACS Nano 6, 10992-10998, 2012
3. Lermusiaux L., Bidault S., *Increasing the Morphological Stability of DNA-Templated Nanostructures with Surface Hydrophobicity*, Small 11, 5696-5704, 2015