# Real-time Monitoring of 3-Dimensional growth of Asymmetric Single Nanoparticle

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Gold nanoparticles have been widely studied because of their versatile applicability and great potential in detecting, targeting and even therapeutic areas. Therefore, understanding of the single nanoparticle growth mechanism provides a crucial key to synthesize more complex and desirable shaped nanoparticles and to achieve excellent performances with them. In this regard, some efforts have been performed for examining growth mechanism of nanoparticles and observing them in real-time, via UV/vis spectroscopy, cyclic voltammetry, and in-situ TEM analysis. Nevertheless, the growth mechanisms of a single nanoparticle are still unclear, due to the difficulty in collecting the information from the only single particle and absence of real-time visualization tools under the synthetic condition. To overcome this, we set up a real-time observation system composed with dark-field microscope and spectrophotometer, and examined the growth mechanism of a single gold nanorod (GNR), which is generated from the existing seeds in an aqueous surfactant solution. This allows us to collect the 3-dimensional informations by simultaneously tracking its optical property as well as visualizing the time-resolved growth of a single GNR.