In situ X-ray Absorption Spectroscopy (XAS) has been used to study the reduction of palladium during the hydrothermal synthesis, thereby serving as an entryway into fundamentally understanding the relationship between the coating properties and the underlying reduction and growth processes governing mineralization on biotemplates. Additionally, the electrical conductivity of the synthesized nanorods was found to be comparable with those of electrochemically grown palladium nanowires, thus demonstrating the potential of these materials in biotemplated nanoelectronic devices.Genetically engineered Tobacco Mosaic Virus (TMV1Cys) has been applied as an expedient template for facile and controlled nanorod synthesis at mild operating conditions. In recent years, the discovery of the hydrothermal synthetic scheme, performed in the absence of a reducing agent, has allowed the production of higher quality nanorods with more uniform coating, narrower size distribution and easily controllable sizes. In this study, the mechanism for reduction and growth in this process and the potential opportunity it offers to control nanorod properties during applications has been explored. Reduction and grain growth were analyzed by monitoring the evolution of absorption spectra over the course of the reaction. Valuable information about the nature and kinetics of the process is also acquired. The resulting organic-inorganic hybrid nanorods were subsequently electrically characterized through a focused ion beam (FIB) assisted nano-gap approach. Differences in nanorod conductivities after different growth cycles were studied. Results acquired indicate that the reduction of palladium on the biotemplate is autocatalytic and first order in palladium. Also, the resulting electrical conductivity of double coated palladium nanorods compare reasonably with other grown palladium nanowires. In summary, insight into the hydrothermal synthesis is attained via XAS, the nanorods acquired are comparable with those produced from more complex synthesis and a simple electrical characterization method has laid a foundation for design and characterization of nanorods with specific electrical properties for nanoelectronics applications.