Robust and Cost Efficient Method for Fabrication of Tungsten Tips for Scanning Tunneling Microscopy

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Extended Abstract

The quest for green energy has sparked considerable interest in Photosystem I (PS I), the photosynthetic protein complex, that acts like a nano-scale biological photodiode and enables light-activated charge separation (with nearly~100% quantum efficiency) to facilitate unidirectional electron flow. The structural and photo-electrochemical properties of PS I make it suitable for incorporation into bio-electronic or hybrid photochemical devices. The first step towards the rational design of such devices requires a fundamental understanding of the morphological and electric properties of PS I on various donor substrates/electrodes. Scanning Tunneling Microscopy (STM) is a powerful scanning-probe technique that allows simultaneous high-resolution analysis of localized topography and charge transport properties at atomistic resolution. To this end, preparation of quality STM tips is critical in acquiring high quality images and in turn tunneling current of PS I nanostructures. Such demand for high-precision STM tips has launched the exploration of many techniques used to produce STM tips with uniform and controlled tip radius and geometry. Each of these methods is marked by distinct parameters which demand highly specific configurations. Our method, facilitated by electrochemical (EC) etching of tungsten wire, allows the creation of sharp and clean STM tips via judicious selection of the process parameters. In this presentation an overview of our novel device that produces robust, efficient tips that provide the design and operation of our affordable, cutting-edge alternative to costly manufacturing of STM tips will be discussed.