

## Methylviologen mediated electrosynthesis of palladium nanoparticles stabilized with CTAC

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### Abstract

© 2016 The Electrochemical Society. All rights reserved. Efficient electrosynthesis of ultrasmall palladium nanoparticles stabilized with CTA<sup>+</sup> cetyltrimethylammonium cations (Pd@CTA<sup>+</sup>) was carried out in an aqueous medium by methylviologen mediated electroreduction of poorly soluble aggregates ([PdCl<sub>4</sub>]<sup>2-</sup>·2CTA<sup>+</sup>)<sub>n</sub> of [PdCl<sub>4</sub>]<sup>2-</sup> anionic complex with CTA<sup>+</sup> cations on a glassy carbon electrode at potentials of the MV<sup>2+</sup>/MV<sup>•+</sup> redox couple. ([PdCl<sub>4</sub>]<sup>2-</sup>·2CTA<sup>+</sup>)<sub>n</sub> aggregates are reduced directly on the electrode at a low rate and the generated metal is deposited on the electrode. In the case of mediated reduction, the metal is not deposited on the cathode, and after passing of  $Q = 2 F$  quantitative conversion from [PdCl<sub>4</sub>]<sup>2-</sup> to Pd@CTA<sup>+</sup> nanoparticles occurs in the solution bulk. These particles are positively charged (zeta-potential is 66.8 mV) and their hydrodynamic diameter is 18 nm. Separated Pd@CTAC nanoparticles are combined into larger aggregates due to coalescence of the organic shell. The predominant shape of metal nanoparticles is an imperfect sphere with a diameter of  $5 \pm 3$  nm, and the average size of the metal crystallites is 4.66 nm.

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