

### Electrocatalysis on Platinum Nanoparticles: Crystallinity Effect on Methanol Oxidation

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In this study, we developed a new strategy for synthesizing Pt nanoparticles (NPs) in room temperature ionic liquid, 1-butyl-3-methylimidazolium tetrafluoroborate, under one atmospheric pressure plasma. The Pt-NPs with a size of 3 nm were uniformly distributed on the surface of a copper grid due to the formation of ionic liquid supramolecule on the surface of PtNPs. The particle size, shape and crystallinity of the Pt-NPs were further controlled by a mixture of hydrogen and argon gases, stabilizers and plasma reduction time. The shape of the PtNPs changed from spherical to cube-like, while a polycrystalline structure of the PtNPs was formed when the plasma reduction time increased from 10 to 40 min. As a result of applying PtNPs as electrochemical catalysts to the oxidation of methanol, the PtNPs synthesized with a 10 min plasma reduction time had a better forward sweep of catalytic performance in oxidation of methanol while the cube-like structure was better for backward sweep of the electrochemical catalysts. Furthermore, the methanol oxidation with the PtNPs, prepared from 10 min of plasma reduction time, shows good stability and high  $J_f/J_b$  value.