UNLEASHING THE POTENTIAL OF SEMICONDUCTOR NANOWIRES AS ADVANCED NANOCATALYST SUPPORTS

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Introduction

This study is focused on the design and optimization of semiconductor nanowire (NW)-supported palladium (Pd) nanocatalysts, exploring gallium phosphide (GaP) NWs as support material. The use of semiconductors has been investigated to increase the catalytic activity of the well-established Pd catalyst 1,2. GaP NWs offer a distinct advantage due to their high aspect ratio, providing a larger surface area that enhances the catalytic activity of Pd catalysts. The biocompatibility of GaP NWs further broadens their applications, making them appealing for potential synergy effects. The investigation aims to understand the influence of NW morphology and post-NW growth treatment on catalytic performance, contributing to a broader understanding of key parameters shaping nanocatalyst functionality.

Methods

Nanocatalysts were synthesized by depositing Pd nanoparticles (NPs) onto GaP NWs with varied V/III ratios. A subset of samples underwent heat treatment. Catalytic performance was assessed, and wettability analysis was conducted to determine surface characteristics. Electron microscopy allowed to determine morphology and crystal structure.

Results

Catalytic evaluations revealed substantial variations in performance based on NW morphology and annealing treatments as seen in Figure 1. Different NW structures exhibited diverse catalytic behaviors, emphasizing the crucial role of morphology in shaping nanocatalyst functionality. Additionally, wettability analysis demonstrated a direct correlation between nanowire morphology, annealing treatment, and surface properties.

Conclusion

This comprehensive study underscores the significance of tailoring nanocatalyst design through a nuanced understanding of NW morphology and annealing effects. The observed variations in catalytic performance and wettability provide valuable insights for strategically developing semiconductor nanowire-supported Pd nanocatalysts.