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Rational Design of High-Performance Continuous-Flow Microreactors Based on Gold Nanoclusters and Graphene for Catalysis (Article)

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Abstract

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In this work, we rationally designed a high-performance microreactor system for continuous-flow catalysis. The membrane consists of ultrasmall gold nanoclusters (AuNCs) and two-dimensional graphene. The Au cores of the NCs act as catalysts, while their ligands have two functions: (1) protecting the Au cores to avoid agglomeration and (2) providing a well-defined surfactant assembly to disperse graphene in aqueous solution. Hydrogenation of 4-nitrophenol (4-NP) was employed as model reaction to evaluate catalytic activity. The catalytic membrane microreactor demonstrated excellent catalytic activity and stability, where complete 4-NP conversion was readily achieved via a single pass through the membrane. This desirable performance was maintained over 12 h of continuous operation, although a certain amount of organic buildup on the membrane was observed. The catalytic membrane microreactor outperforms conventional batch reactors due to its improved mass transport. 4-NP-spiked real water samples were also completely converted. This study provides new insights for the rational design of membrane reactors for industrial applications. © 2018 American Chemical Society.

SciVal Topic Prominence

Topic: Nanoclusters | Gold | fluorescent gold

Prominence percentile: 99.952

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Author keywords

4-Nitrophenol | Catalytic membrane microreactor | Gold nanoclusters | Reduced graphene oxide

Indexed keywords

Engineering controlled terms: Batch reactors | Bioreactors | Catalysis | Graphene | Membranes | Nanoclusters | Solutions | Structural design

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Engineering uncontrolled terms: 4-Nitrophenol, 4-nitrophenol (4-NP), Catalytic membrane microreactor, Continuous flow microreactors, Continuous operation, Gold nanocluster, Reduced graphene oxides, Surfactant assemblies

Engineering main heading: Catalyst activity

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