Activated Carbon

1- Effect of K-Modified Blue Coke-Based Activated Carbon on Low Temperature Catalytic Performance of Supported Mn-Ce/Activated Carbon

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Abstract

To clarify the K modified effects over activated carbon (AC) supported Mn-Ce oxide catalysts, several Mn-Ce/AC and xK-Mn-Ce/AC mixed oxide catalysts prepared via an impregnation method supported on AC were investigated for low-temperature selective catalytic reduction (SCR) of NO with NH3 in the simulated sintering flue gas. The Mn-Ce/AC catalyst with a K loading of 8% showed the highest catalytic activity, corresponding to 92.1% NO conversion and 92.5% N-2 selectivity at 225 degrees C with a space velocity of 12,000 h(-1). Furthermore, the 0.08K-Mn-Ce/AC catalyst exhibited better resistance to SO2 and H2O than Mn-Ce/AC, which could convert 72.3% and 74.1% of NO at the presence of 5% SO2 and H2O, respectively. After K modification, the relative ratios of Mn4+/Mnn(+) as well as Ce3+/Cen(+) and surface adsorbed oxygen increased. Additionally, the reduction performance of the catalyst was improved obviously, and both acid strength and quantity of acid sites increased significantly after the K species were introduced in Mn-Ce/AC. Especially, the NO adsorption capacity of the catalyst was enhanced, which remarkably promoted the denitration efficiency and SO2 resistance. The SCR of NO with NH3 on K-Mn-Ce/AC catalysts followed the L-H mechanism.

Keywords
Keywords Plus
NOX STORAGE PERFORMANCEOXIDE CATALYSTSH-2 EVOLUTIONSO2 TOLERANCEREDUCTIONNH3REMOVALSCRNH3-SCRN2O

2- Azurobine degradation using Fe2O3@multi-walled carbon nanotube activated peroxymonosulfate (PMS) under UVA-LED irradiation: performance, mechanism and environmental application

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Abstract

Food dyes are a large group of dyes which have been widely used in the food industry. The presence of them in aquatic media results in water pollution. In this work, a heterogeneous photo-assisted peroxymonosulfate (PMS) activation process was used to degrade Azorubine (AZB). Fe2O3 loaded on multi-wall carbon nanotube (Fe@MWCNT) was synthesized and applied to activate PMS under UVA-LED irradiation. Fe@MWCNT catalyst was characterized by XRD, FTIR, EDX-map, BET, FESEM, and TEM analyses. UVA-LED/Fe@MWCNT/PMS process removed around 95% of AZB from aqueous solution under pH= 5, PMS= 1.8 mM, and 130 mg/L Fe@MWCNT. Sulfate radicals showed a higher contribution for AZB degradation compared to hydroxyl radicals and singlet oxygen. Pseudo-first-order model was fitted on AZB degradation with a rate constant of 0.095 min(-1). Bicarbonate ions and humic acid had an ultra-inhibitory effect on the oxidative process. Carboxylic acids were monitored during AZB degradation, with the results indicating that aromatic rings of AZB were opened by the attack of sulfate and hydroxyl radicals. Six cycles of the catalyst reuse demonstrated no significant change in the performance of the

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UVA-LED/Fe@MWCNT/PMS process. The implementation of the UVA-LED/Fe@MWCNT/ PMS process was also successfully studied on other food dyes and real wastewater. UVA-LED/Fe@MWCNT/ PMS process was an efficient approach for the degradation of organic contaminants in water with high stability.

Keywords

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Sulfate radicalsFood dyeAzorubineMulti-wall carbon nanotubeHematite

Keywords Plus

ADVANCED OXIDATION PROCESSESHETEROGENEOUS FENTON-LIKEEFFICIENT DEGRADATIONPERSULFATE ACTIVATIONFOOD DYECATALYSTNANOPARTICLESKINETICSNANOCOMPOSITESREMOVAL

3- Carbon Nitride Supported High-Loading Fe Single-Atom Catalyst for Activating of Peroxymonosulfate to Generate O-1(2) with 100 % Selectivity

By:
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Abstract

Singlet oxygen (O-1(2)) is an excellent active species for the selective degradation of organic pollutions. However, it is difficult to achieve high efficiency and selectivity for the generation of O-1(2). In this work, we develop a graphitic carbon nitride supported Fe single-atoms catalyst (Fe-1/CN) containing highly uniform Fe-N-4 active sites with a high Fe loading of 11.2 wt %. The Fe-1/CN achieves generation of 100 % O-1(2) by activating peroxymonosulfate (PMS), which shows an ultrahigh p-chlorophenol degradation efficiency. Density functional theory calculations results demonstrate that in contrast to Co and Ni single-atom sites, the Fe-N-4 sites in Fe-1/CN adsorb the terminal O of PMS, which can facilitate the oxidization of PMS to form SO5.-, and thereafter efficiently generate O-1(2) with 100 % selectivity. In addition, the Fe-1/CN exhibits strong resistance to inorganic ions, natural organic matter, and pH value during the degradation of organic pollutants in the presence of PMS. This work develops a novel catalyst for the 100 % selective production of O-1(2) for highly selective and efficient degradation of pollutants.

Keywords
Author Keywords

degradationFe single-atom catalystgraphitic carbon nitrideorganic pollutantssinglet oxygen

Keywords Plus

OXYGEN GENERATIONSTRATEGYFACILE

4- Degradation of benzene, toluene, and xylene with high gaseous hourly space velocity by double dielectric barrier discharge combined with Mn3O4/activated carbon fibers

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Abstract

A novel strategy for the degradation of high gaseous hourly space velocity benzene, toluene, and xylene (BTX) by double dielectric barrier discharge (DDBD) coupled with Mn3O4/ activated carbon fiber (ACF) catalysts was proposed in this work. A series of Mn3O4/ACF catalysts were synthesized using the hydrothermal method and characterized. The results showed that all the prepared catalysts could improve the degradation of BTX in the DDBD system and inhibit the production of ozone. Among the catalysts with different Mn loading, the 5.6%Mn3O4/ACF, with the highest Mn(+3) content (43.2%) and the highest absorbed oxygen content (38.5%), presented the best catalytic performance. In the 5.6% Mn3O4/ACF + DDBD system, the degradation efficiency of benzene, toluene and xylene could reach 49.9%, 79.7% and 97.1%, respectively, with a specific input energy of 400 J l(-1). The carbon balance and CO2 selectivity, meanwhile, were 83.3% and 51.1%, respectively. It seemed that Mn(+3) and absorbed oxygen content could be a reference for the catalytic performance of Mn3O4/ACF catalysts. The higher the Mn (III) and absorbed oxygen, the better the catalytic performance of the Mn3O4/ACF catalysts. The organic by-products were identified by chromatography-mass spectrometry, and a possible reaction mechanism of BTX in the DDBD reactor and catalyst surface was proposed based on the composition of organic by-products.

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Keywords
Author Keywords
high GHSV BTXDDBD-catalysis systemMn3O4ACFreaction mechanism
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ORGANIC-COMPOUNDS VOCSNONTHERMAL PLASMACATALYTIC-OXIDATIONREMOVALDECOMPOSITIONTEMPERATUREABATEMENTMN3O4AIR

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5- Nanochemistry approach for the fabrication of Fe and N co-decorated biomass-derived activated carbon frameworks: a promising oxygen reduction reaction electrocatalyst in neutral media

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Abstract

The sluggish nature of the cathodic oxygen reduction reaction (ORR), and the expensive price of the precious metal-based nanocatalysts are the biggest obstacles to the practical applications of cutting-edge technologies including metal-air batteries and fuel cells. Hence, it is crucial to engineering a scalable-production pathway for the fabrication of a high-performance ORR catalyst. Herein, it was aimed to boost the performance of the ORR in neutral media, especially for microbial fuel cells, by tailoring a biomass-derived ORR electrocatalyst. In this regard, with the approach of nanochemistry, which is concerned with the fabrication of building blocks that vary in size, surface, shape, and defect characteristics, iron- and nitrogen-doped activated carbon framework (Fe,N-AC) was derived from waste orange peels by a two-stage pathway comprising microwave-assisted chemical activation and the thermal annealing processes. The physicochemical characterizations confirmed the successful co-doping of iron and nitrogen atoms to the activated carbon skeleton with the hierarchically ordered porous structure. Thanks to the

interdependent effects of metal and heteroatoms in the structure, as well as the enlarged specific surface area (1098 m(2).g(-1)), Fe,N-AC catalyst offered a superior ORR activity thru the 4-electron transferring way (n = 3.969) with long-term stability (81.4% retention of initial current over the period of 7200 s). The half-wave potential was determined as 0.871 V by the introduction of iron and nitrogen to the nanoarchitecture, implying the boosting impact of the iron and nitrogen decoration. Moreover, the exceptional electrocatalytic activity of Fe,N-AC was validated by an onset potential of 0.951 V that was ca.16 mV smaller than that of Pt/C catalyst (0.967 V). The accelerated S2- poisoning test of Fe,N-AC catalyst was outperformed to Pt/C catalyst, thereby foreboding its practical utilization in MFCs. The current loss of Pt/C catalyst was determined almost five times that of Fe,N-AC catalyst at 5 mM S2- concentration. The findings paved the course for the engineering of the state-of-the-art low-cost nanocatalyst by converting agricultural biomasses to a multi-functional advanced material to be employed in sustainable energy conversion systems.
[GRAPHICS]

Keywords
Author Keywords
BiomassOxygen reduction reactionNeutral mediaIron and nitrogen dopingActivated carbonWaste orange peel
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ENHANCED CATHODE PERFORMANCEPOROUS CARBONEFFICIENT CATALYSTFACILE SYNTHESISPASTE ELECTRODEAIR-CATHODENANOPARTICLESWASTEGRAPHENEMETHANOL