

# Multifunctional Nanocatalysts with Controlled Site-Isolated Functional Groups on Solid-State Mesoporous Materials



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## Invention

Mesoporous functionalized synthetic scaffolds are frequently used as catalysts in industry for bulk reactions. The carbon-carbon bond-forming reaction is the most widely used method in industry. However, side reactions often occur when similar reactants are present, leading to decreased purity and lower reaction yield. Attempts to create selective catalytic scaffolds have been largely inefficient and are only capable of catalyzing hydrophobic reactants. This invention describes a method of grafting site-isolated catalytic functional groups so as to increase efficiency of the C-C bond-forming reaction, specifically during Nitroaldol reactions. The method has four times greater catalytic efficiency when compared to analogous materials. Additionally, site-isolated grafting of secondary functional groups enables tunable surface modification in order to increase efficiency of catalytic selectivity.

## Technology

The method entails site-isolated grafting of catalytic functional groups and secondary, surface modification functional groups. By using a polar, protonic solution such as isopropanol, aminoorganosilane (AOS) groups can be efficiently grafted onto the MCM-41 mesoporous substrate. The AOS groups can form hydrogen bonds with either the solvent or the surface silanol groups, and are thus well distributed throughout the solvent. This results in an even distribution of AOS groups on the substrate. In order to promote selectivity of catalysis, secondary functional groups are added to the substrate. These organic functional groups attract the appropriate reactants toward the catalytic site. By selecting the type and concentration of functional group, surface properties, and thus selectivity, can be tuned.

## Applications

- Increasing yields of C-C bond forming reactions
- Nitroaldol reactions
- Synthesis of highly purified products
- Large-scale bulk reactions
- Pharmaceuticals

## Advantages

- Tunable surface modification (hydrophilicity, hydrophobicity)
- Capable of reacting with hydrophilic or hydrophobic substances
- Increased catalytic efficiency
- Reaction time completed within minutes
- Recyclable scaffold
- Easy to synthesize and use

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