Intermetallic Base-Metal Catalysts for the Selective Functionalization of Acetylene and Multifunctional Organic Compounds

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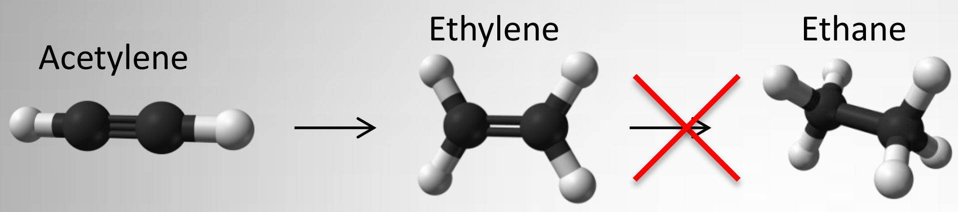
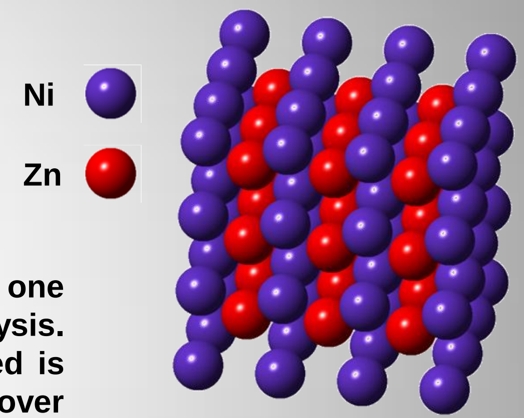
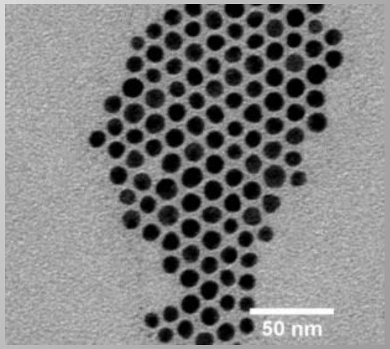




NiZn crystal structure

Catalysts that exhibit chemoselectivity, or the preferential reactivity of one functional group over another, are highly sought after in the field of catalysis. An example of a reaction where a catalyst with chemoselctivity is required is acetylene semi-hydrogenation. Preferential reactivity of triple bonds over double bonds allows for trace acetylene to be removed from ethylene feed streams destined for ethylene polymerization. A good catalyst for this reaction converts all of the acetylene to ethylene without further converting any ethylene to ethane. The catalyst that is industrially used to perform this reaction is a palladium-silver alloy which demonstrates high selectivity towards ethylene. We are developing catalysts that are composed of nickel and zinc, two abundant metals that allow for the creation of low-cost alternatives to palladium-silver. We have found that the amount of nickel and zinc in the catalysts influences selectivity and that oxidation of the zinc may play a role in enhancing selectivity towards ethylene. Using a combination of both theory and experimental work, we are determining the reason for the enhanced selectivity of nickel-zinc materials in hopes that our work leads to practical catalysts that are used industrially for chemoselective hydrogenations.



NiZn nanoparticles