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Nanocrystals are playing an increasingly significant role in society. Platinum nanoparticles are used in catalytic converters (most widely known for their application in cars) to convert carbon monoxide, other hydrocarbons, and nitrogen oxides into less hazardous gasses with lower greenhouse effects. Gold nanoparticles have been used to allow for targeted drug delivery, as well. Morphology can play an important role in the performance of nanoparticles, particularly in catalysis. Different crystal shapes result in different crystal facets being exposed at the surface. Reactants can adsorb to the different facets based on the facets' surface energies and manner in which its atoms are arranged on the surface. In order to optimize nanocrystal performance, further work is necessary to better understand the effects of morphology on catalytic performance for specific reactions and catalysts. Cuprous oxide, a well-established nanocrystal catalyst that has demonstrated the ability of oxidizing carbon monoxide and producing hydrogen gas from water, was chosen as the subject of our work. The effects of a variety of factors including atmospheric composition and type of surfactant on the size and morphology of cuprous oxide were determined. An argon atmosphere was shown to smooth the edges of the particles, relative to their synthesis under atmospheric conditions. The surfactant PVP was shown to stabilize the [111] crystal facet, leading to an octahedral shape, while ascorbic acid led to cubic nanocrystals with [100] facet on their surface. An increased concentration of reducing agent (both glucose and ascorbic acid) allowed for a decrease in nanoparticle size. With these results, cuprous oxide nanocrystals can be reliably produced in a variety of shapes and sizes, allowing for further work to be conducted on evaluating the effects of different morphologies—and their resultant crystal facets—on catalytic activity.