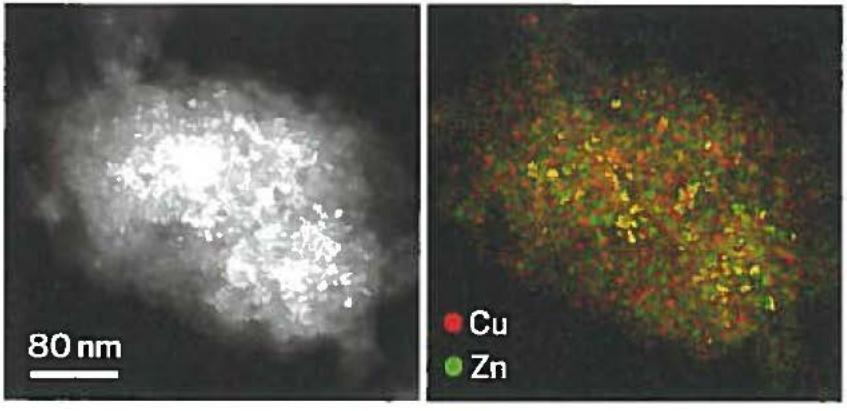
CATALYSIS

▶ Methanol synthesis hinges on catalyst structure

A study of a series of copper nanocrystals confirms that their surface structures directly affect how well the crystals catalyze conversion of synthesis gas ($CO + H_2$) to methanol (*Nat. Commun.* 2016, DOI: 10.1038/ncomms13057). Scientists have debated for decades whether this industrial reaction for making methanol is sensitive to the structure of the copper catalyst surface or simply requires the presence of the catalytic metal. Other industrial-scale catalytic reactions fall squarely into the "structure sensitive" or "insensitive" categories, which is key information for maximizing catalyst performance. To settle the debate, Utrecht University's Roy van den Berg, Krijn P. de Jong, and coworkers in conjunction with colleagues at catalyst manufacturer Haldor Topsoe synthesized 42 batches of supported copper catalysts with and without zinc, a catalyst promoter, in the 2- to 15-nm-diameter size range—a range in which crystal surface structure depends strongly on crystal size. The team analyzed the crystals with X-ray diffraction and electron microscopy methods and then ran a series of catalysis tests at conditions similar to those of commercial methanol processes. The group determined that regardless of the presence or absence of zinc, particles 8 nm in diameter and smaller are far less active than larger particles because the smaller particles cannot accommodate the configurations of atoms that are catalytically active.—MITCH JACOBY



Analysis of copper nanocrystals (left) with a color-coded element map (right) indicates that size matters: These 7.4-nm uniformly sized particles are a tad too small to catalyze methanol synthesis.