Catalyzed reactions involving methanol (methanol steam reforming and methanol synthesis) are of current interest due to methanol’s potential as an energy storage medium. Methanol is a reasonably high density source of hydrogen; its ease and safety of transportation makes it a viable candidate for portable hydrogen fuel cell applications, using hydrogen formed by catalyzed steam reforming of methanol. Complimentarily, the simplicity of methanol synthesis makes it an attractive candidate for the temporary storage of excess power, coming from a power grid that is increasingly supplied by intermittent energy sources such as wind and solar.

Copper metal is the catalyst that is currently used in these reactions; however, Cu⁰ suffers from rapid deactivation. It has been shown that the tetragonal PdZn phase, while more expensive than Cu⁰, serves as a much more robust catalyst for reactions involving methanol. An additional requirement for fuel cell application is that the methanol steam reforming reaction be 100% selective toward CO₂ (as opposed to CO) production, which is true for tetragonal PdZn.

However, in practice, we have found that practical, supported (Al₂O₃ or Al₂O₃+ZnO) PdZn catalysts are commonly composed of a mixture of phases, including Pd⁰, Pd₂Zn, and ZnO, in addition to tetragonal PdZn. As a simplification, we have focused our studies upon bulk, unsupported PdZn of various compositions, synthesized using an aerosol, or spray pyrolysis process. This method of synthesis produces fine particles with controlled composition. These powders have been studied using in situ X-ray diffraction to examine phase development and the effects on catalyst performance.