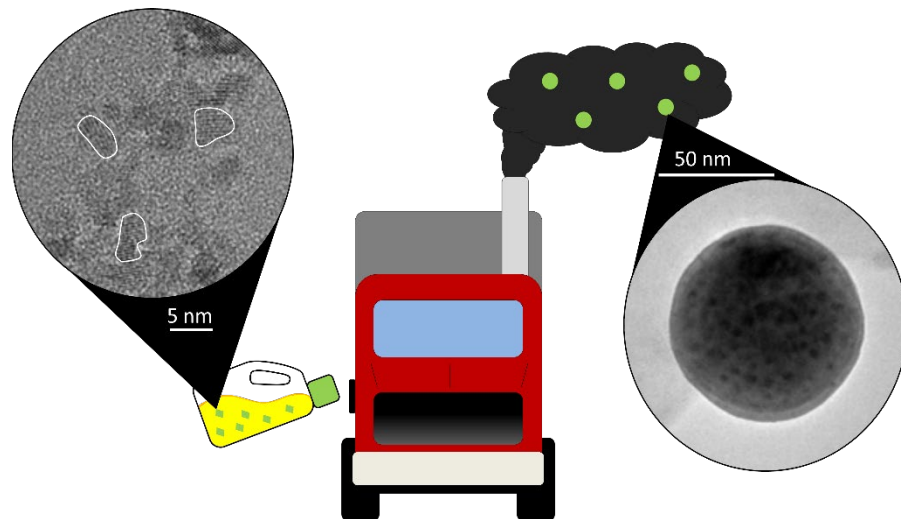


# Transformation of CeO<sub>2</sub> nanoparticles in diesel engine fuel and exhaust, and plant toxicity

Nanoscale cerium oxide (CeO<sub>2</sub>) is used as a diesel fuel additive to reduce particulate matter emissions and increase fuel economy, but its fate in the environment has not been established. We determined that the combustion process induces significant changes in the size and morphology of the particles; ~15 nm aggregates consisting of 5 to 7 nm faceted crystals in the fuel additive became 50 to 300 nm, near-spherical, single crystals in the exhaust. The results of this study suggests that pristine, laboratory-produced, nanoscale cerium oxide is not a good substitute for the cerium oxide released from fuel borne catalyst applications. Exhausted ceria particles added to laboratory soils in environmentally realistic concentrations did not affect *Brassica napus*, a well studied broadleaf plant.



*Cerium oxide released as a result of the combustion of diesel fuel containing the additive Envirox™, which utilizes suspended 5-7 nm cerium oxide to reduce particulate matter emissions and increase fuel economy (left image), was captured from the exhaust stream of a diesel engine and was characterized using a combination of bulk analytical techniques and high resolution TEM (right image).*

James Dale, Steve Cox, Marina Vance, Linsey Marr, and Michael Hochella (Virginia Tech). *Environmental Science and Technology*, 2017 (published) and 2018 (submitted).