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Project Title: Operando studies of nanoparticles for exploring new surface chemistry and structure at the nanoscale under reaction conditions

Nitrogen Oxides (NO_x) pose serious environmental risks and unfortunately they are a common byproduct in diesel engines. Selective catalytic reduction (SCR) is a common method that uses ammonia as a reducing agent to produce diatomic nitrogen and water. The most common catalyst for SCR is vanadium oxide (V_2O_5), yet there are toxicology concerns and lack of durability at higher temperatures. Ferric oxides have been shown to be capable of catalyzing the reduction of NO_x and they can tolerate higher temperatures. This summer I worked on the synthesis of maghemite (□-Fe_2O_3) nanorods and measured its ability to catalyze the reduction of NO_x. The synthesis of □-Fe_2O_3 was adapted from literature and the TEM images can be seen in Figure 1.

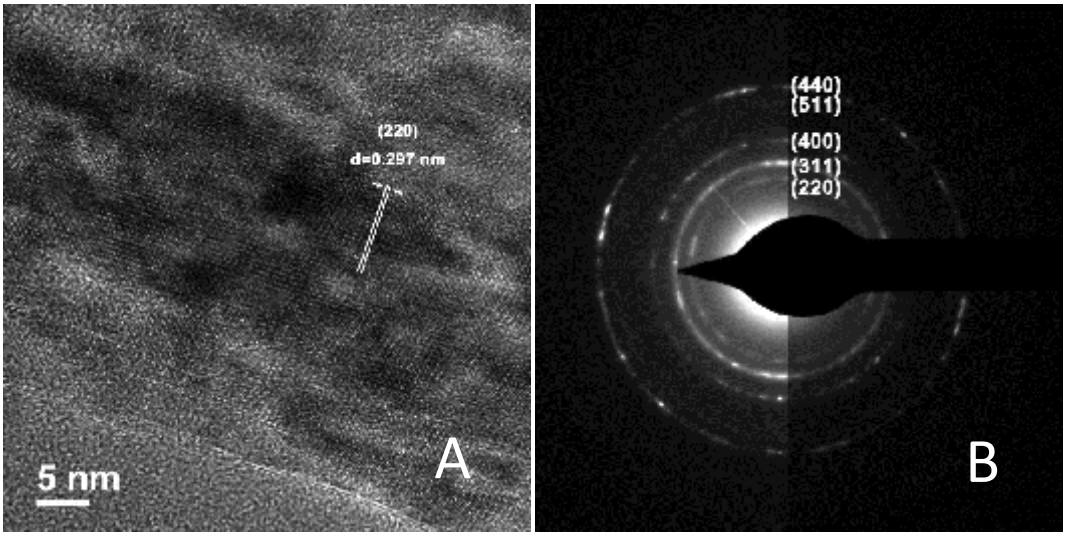

Figure 1 **A)** TEM image of the □-Fe_2O_3 nanorod, a (220) face is highlighted **B)** the selected area electron diffraction (SAED) shows the different exposed faces of the nanorod

From TEM images, the length of the nanorods averaged close to 300 nm while the diameter was 50 nm. Next the reaction was carried out in AP-XPS; the catalyst was successful in reducing NO_x but it is also exhibited deactivation. It was difficult attaining pure □-Fe_2O_3, the most common impurity was the presence of □-Fe_2O_3 and this lead to a weaker catalytic performance than anticipated. Water is a known poison to iron oxides, and therefore the next step would be to tune the catalyst through doping or the addition of another metal.