

# Synthesis and Characterization of Molecular Monolayer Directed Nanoscale Catalysts

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Our research aims to produce, study, and understand catalytically active metal nanoparticles on carbon substrates. Specifically, our research has focused on the synthesis of uniform metal nanoparticles over large areas and the catalytic activity of these particles. This research could have significant impacts on synthetic organic chemistry, changing industrial methods for production.

The diagram illustrates the synthesis of a molecular monolayer directed nanoscale catalyst in four stages:

- Carbon Surface:** A surface with three carboxylic acid groups ( $\text{C}=\text{O}$  and  $\text{OH}$ ).
- Tin Bath:** A dashed arrow labeled "Tin Bath" leads to a surface where the carboxylic acid groups are bridged by tin atoms ( $\text{Sn}^{2+}$ ).
- Palladium Bath:** A dashed arrow labeled "Palladium Bath" leads to a surface where the carboxylic acid groups are bridged by palladium atoms ( $\text{Pd}^0$ ), with tin ions ( $\text{Sn}^{4+}$ ) also present.
- Coffee:** A dashed arrow labeled "Coffee" leads to a surface where a large blue octagonal nanoparticle ( $\text{PdNP}$ ) is formed.

