Telescoping Catalysis: Understanding Sustainability and Accountability

Catalysis, a key component of chemical manufacturing, has significantly influenced the industry by facilitating the production of pharmaceuticals, polymers, fuels, and fertilizers. However, heavy reliance on fossil resources in these processes has led to environmental issues.[1-2] Recent analysis has revealed that over 99% of *ca.* 500 chemicals produced exceed the safe operating limits of our planet, making them unsustainable.[3] To tackle this challenge, sustainable catalytic technologies are essential.[4]

Sustainable catalysis involves integrating atomic-level design considerations with assessments of planetary impact, including the impacts of organic solvents, ligands, and metal salts.[5-9] Prioritizing sustainability metrics, fostering industry partnerships, and embracing circular economy principles are all crucial. The development of catalytic processes that optimize atomic-scale pathways and align with broader environmental impacts will be discussed in this presentation. The role of ligands in achieving sustainability,[6] examples of sustainable ligand-free iridium[7] and palladium catalysis,[8] and transition metal-free scalable electrocatalytic pathways[9] will be explained. Specific demonstrations will include stereoretentive aromatic ring reduction, asymmetric Suzuki-Miyaura couplings, efficient Buchwald-Hartwig aminations, and selective fluorination chemistry.

"Determining what is sustainable and what is not can be challenging due to the subjective factors involved"

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