Earth Abundant Mixed Metal Oxide Catalysts for Polyolefin Upcycling

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The catalytic hydrogenolysis of polyolefins offers a selective pathway to covert plastic waste to value-added hydrocarbons. However, the use of noble metals such as Ru or Pt remains a significant barrier to industrial scale up.[1-2] In this work, we demonstrate bulk earth abundant mixed metal oxide (MMO) catalysts, which are highly effective for liquid selective polyolefin hydrogenolysis, with liquid range hydrocarbon yields over 75% at a total conversion of over 90% while keeping methane yields below 3% at 260 °C for 1.5 hour and 275 °C for 1 hour with 20 bar of H_2. Using both X-ray Bragg and pair distribution function (PDF) in combination with mechanistic studies show these catalysts system have a preference for C-C backbone cleavage, with C3, C6, and C9 selectivity for polypropylene hydrogenolysis. We have engineered a scalable, highly efficient, and cost-effective catalyst system for the efficient recycling of polyolefin waste.

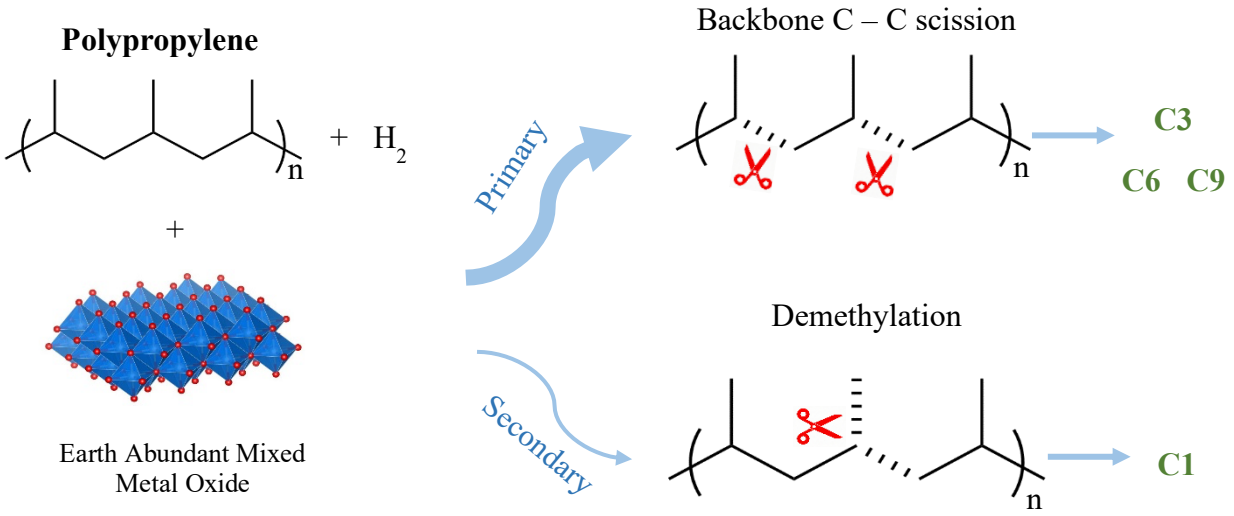


Figure 1. *Proposed mechanistic scheme of polypropylene hydrogenolysis of the earth abundant mixed metal oxide catalyst.*

[1] L. Nogueroles-Langa *et al.,* Nat. Commun. (2025). 9791
[2] S. D. Jaydev, Chem. Sus. Chem. (2021). 23, 5179-5185.