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ABSTRACT:

Supported Nano-Cu catalysts for the transformation of bio-alcohols into Sustainable Aviation Fuels

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In the biorefinery context, bioethanol upgrading has been identified as a valuable approach to implement the bioeconomy paradigm for fuels and chemicals production. In this work, the gas-phase, continuous flow catalytic upgrading of ethanol to blends with features close to those suitable for jet fuel is tackled through an innovative strategy based on the promotion of several reactions in cascade. Catalytic transfer hydrogenation, aldol condensation, dehydrogenative coupling, and ketonization were combined in a one-pot approach over a relatively simple and cheap catalytic system consisting of nanosized metallic Cu particles supported on zirconium oxide. The resulting cascade reaction scheme led to the production of a blend of oxygenated adducts in the C6-C14 range with promising properties for use as jet fuel. By tailoring the features of the support and/ or co-feeding hydrogen to the reactor, up to 40% per-pass yield for the jet fuel range fraction, with ethanol conversion above 85%, was achieved, simultaneously enhancing catalyst stability and lifetime. Main light by-products could be recycled, which led to a remarkable increase of the process yield [1,2].

[1] A. Gagliardi, G. Balestra, J. De Maron, R. Mazzoni, T. Tabanelli, F. Cavani, Appl. Catal. B: Environment and Energy, 349 (2024) 123865.
[2] T. Tabanelli, F. Cavani, G. Balestra, A. Gagliardi, M. Berruti, WO 2023/157041, assigned to Università di Bologna and GST.