

## Novel porous CaO-MgO promoting $\gamma$ -Al<sub>2</sub>O<sub>3</sub>-catalyzed selective hydrogenation of oleic acid to green bio-gasoline range hydrocarbon fuels with methanol as internal hydrogen source

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**Abstract:** An efficient and highly selective CaO-MgO promoting  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> decarboxylation catalyst has been fabricated with different CaO to MgO mixed ratios via boll-milling method for the regulation product distribution and production of gasoline-kerosene-diesel range hydrocarbons through catalytic conversion of oleic acid (OA) and methanol under self-hydrogen supply conditions. In addition, influencing factors, reaction mechanism, possible reaction pathway and deactivation mechanism were also probed. The results showed that combination of Ca, Mg and AlO<sub>x</sub> was very important to boost oleic acid conversion, and synergy between metal and acid active sites via strong metal-support interactions enhanced deoxygenation-cracking activity. Higher alkalinity CaO boosted C-C/C=C bonds cleavage, MgO offered medium Lewis acid sites; BET and mesopore volume suppressed the excessive hydrocracking reactions, improving bio-gasoline yield. Methanol addition provided active hydrogen atoms to enhance bio-gasoline selectivity at the expense of diesel and heavy oil via olefinic cycles and aromatic cycle mechanisms and reduced coke deposition. The maximum hydrocarbon and bio-gasoline yields of 94.53% and 57.59% were achieved at OA/methanol=5:1, pyrolysis/catalytic temperature=450/500°C using 1 g catalyst at a feedstock input rate of 0.1 ml/min

**Keywords:** Catalytic deoxygenation; CaO-MgO promoting Al<sub>2</sub>O<sub>3</sub> catalyst; Bio-gasoline; Oleic acid; Mechanism

