

## Synthesis of Guerbet alcohols by self and cross condensation reactions of a variety of fatty alcohols and terpenes over Ni/Cu hydrotalcite-derived mixed oxides

W.Y. Hernández<sup>a</sup>, K. De Vlieger<sup>b</sup>, P. Van Der Voort<sup>a</sup>, <u>A. Verberckmoes<sup>b</sup></u> (an.verberckmoes@ugent.be)

<sup>a</sup>Center for Ordered Materials, Organometallics & Catalysis (COMOC), Ghent University, Krijgslaan 281-S3, 9000 Ghent, Belgium. <sup>b</sup>Industrial Catalysis and Adsorption Technology (INCAT), Ghent University, Valentin Vaerwyckweg 1, 9000 Ghent, Belgium.



- Due to the growing importance of renewable feedstocks and use of heterogeneous catalysts the interest in hydrotalcite-derived mixed oxides to perform the Guerbet reaction increased.
- The Compound Annual Growth Rate (CAGR) of Guerbet alcohols in 2016-2024 is 5.6%.



• The Ni/Cu catalysts are tested in the self and cross condensation on a broad variety of starting alcohols.





## **Materials Characterization**



a) XRD patterns obtained for: Calcined mixed oxides Cu(10) (A), Ni(2.5)Cu(7.5) (B); Ni(5.0)Cu(5.0) (C); Ni(7.5)Cu(2.5) (D); Ni(10) (E)

- Combining Cu & Ni leads to:
- Increased stability of Copper
- Increased reducibility of Nickel







Ni/Cu ratio plays significant role in reactivity and selectivity.
Best performance with Ni(7,5)Cu(2,5)for this series

 $\rightarrow$  Catalyst was further optimized towards Ni(9)Cu(1)



## **Products Properties Guerbet alcohols** Use Appearance as liquid, solid gel. .. Wide variety of products suitable for various Lower melting point dependent on chain length applications. Changed viscosity and branching Cosmetics and personal care: as solvents or and polarity emulsifiers Excellent oxidative Detergents & cleaners : as surfactants and colour stability Metal processing: as cooling liquids or Biodegradable lubricants uerbet react product of: Octanol Behenyl alcohol Isostearyl alcohol Others Linear AlcOH vs. GB AlcOH

## Conclusions

The combination of Nickel and Copper leads to a higher stability of the copper, a better reducibility of the nickel and an improved performance in terms of selectivity to the required Guerbet alcohols. Ni(9)Cu(1) is a very versatile and robust catalyst to convert a broad variety of starting alcohols via self and cross condensation to a large variety of end products suitable for various applications dependent on the physicochemical properties of the Guerbet products.

Hernandez, W. Y., De Vlieger, K., Van Der Voort, P., & Verberckmoes, A. Ni-Cu Hydrotalcite-Derived Mixed Oxides as Highly Selective and Stable Catalysts for the Synthesis of beta-Branched Bioalcohols by the Guerbet Reaction. Chemsuschem, 2016, 9(22), 3196-3205