The MAGOL Process: Fatty Alcohols from Nd/Mg catalysis

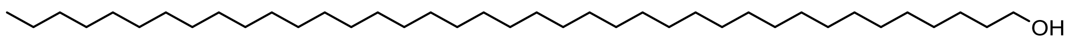
Dr Thomas Chenal – Pr André Mortreux

Prof. Marc Visseaux (UCCS) : marc.visseaux@ensc-lille.fr

International relations office : international@ensc-lille.fr

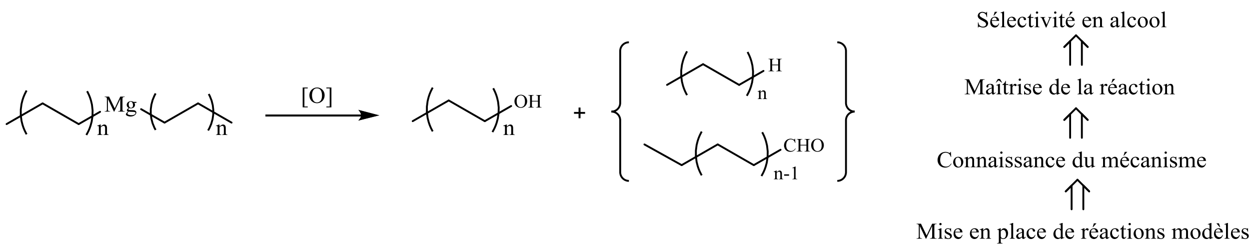
Team MOCAH (Méthodologie Organométallique en CAtalyse Homogène)

The industry is highy interested in polyolefins bearing polar functional end-group. In particular, oligo-ethylenes carrying an alcohol function are high-value added products for their application as lubricants, texturing agents (cosmetics) or bases for compatibilizers (plastics processing).
The properties of these products depend on the quality of the distributions (narrow, adjustable in number of C), the purity in alcohols (rate of functionalization) and the structure of the chain (perfectly linear primary alcohol).
There are two main processes on the industrial scale for the preparation of these fatty alcohols (Scheme 1), starting from ethylene as raw material:
- The first, used by Baker & Hughes Company in Texas, involves several oligomerization / oxidation / reduction reaction steps, via alpha-olefins and epoxides, which represents a certain cost for production.
- The second, implemented at Sasol in Hamburg, uses a **one-pot catalysis** for initiation-propagation-functionalization with aluminum (ALFOL process).



Scheme 1. Example of long-chain linear primary fatty alcohol

An alternative method of replacing aluminum with a **non-toxic metal such as magnesium** could be recoverable provided that it is able to lift the ultimate lock of the oxidation step, which is presently not well understood and controlled.
The chemistry developed in the UCCS Laboratory (team MOCAH) allows the synthesis of long-chain dialkyl-magnesium compounds via a two-component catalytic system. Preliminary tests of reaction with oxygen in dry air, similar to the ALFOL process, led to the formation of a mixture of products, including the majority fatty alcohol, but accompanied by aldehydes and alkanes (Scheme 2).



Scheme 2. Oxidation of a dialkylmagnesium showing the formation of fatty alcohol and by-products

The objective of this project is to lift the lock of the perfect control of this oxidation step, to allow the selective synthesis of fatty alcohols via a **green magnesium process**.

This study gathers coordination catalysis and polymer science. Most of the reactions will be conducted under strict anaerobic conditions (Schlenk lines, glove box, polymerization reactors).

Time period: 6-9 months