GREEN REVOLUTION IN INDUSTRY: HYBRID CATALYSTS FOR A CLEANER AND MORE SUSTAINABLE FUTURE

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ABSTRACT

The Molecular Nanotechnology Laboratory of the University of Alicante, together with the Federal University of Rio de Janeiro, has developed a new class of hybrid catalysts that combine a catalytic phase (zeolites) with a heating phase (silicon carbide nanoparticles) embedded inside. This unique integration enables much more efficient heat transfer during chemical reactions, significantly accelerating them and reducing energy consumption by up to 60%. Faster and more uniform heating results in a higher conversion rate of the reactants, and the combination of micro- and mesoporous structures favours the formation of specific products, improving the selectivity of the reaction.

This technology can be applied in a wide variety of industrial processes, such as chemical (catalytic cracking, etc.), pharmaceutical and energy (biomass processing and CO_2 conversion).

It is looking for companies interested in acquiring this technology for its commercial exploitation through patent license agreements.

ADVANTAGES AND INNOVATIVE ASPECTS

ADVANTAGES OF THE TECHNOLOGY

These new catalysts have the following **advantages**:

1) They are **more efficiently heated**.

2) They have a **higher catalytic activity** than current catalysts, with a **2,5 times higher** conversion rate.

3) The main **zeolite properties** (acidic, textural, structural and morphological characteristics) **are not affected** by the presence of silicon carbide nanoparticles.

4) **No significant blockage of pores** due to the presence of nanoparticles.

5) **Improved selectivity** due to the combination of micro- and mesoporous structures.

6) **Significant improvement in performance** as a result of efficient heat transfer from nanoparticles to reagents.

7) **MARKED REDUCTION IN ENERGY CONSUMPTION (MORE THAN 60%) when comparing conventional zeolites to the materials of the present invention** (*see Figure 2*).

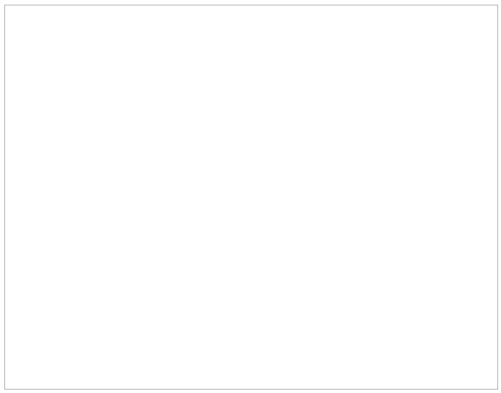

Figure 2: Energy consumed by each catalyst in the isoconversion of 15% benzyl alcohol in the microwave reactor.

INNOVATIVE ASPECTS OF THE TECHNOLOGY

The obtained results show that mixing materials with high microwave absorption and/or induction capacity with catalytic materials is not an effective strategy to accelerate the heating of the catalytic material due to poor contact between them. Therefore, it is essential to ensure a **close contact between the heating phase and the catalytic phase to achieve an efficient microwave-assisted catalysis**. This objective is achieved by the procedure described in the present invention.

MARKET APPLICATIONS

The present invention belongs to the technical field of **catalysed chemical reactions assisted by microwave or induction heating**.

Specifically, it concerns catalysts incorporating additives with high microwave and/or induction absorption capacity.

This novel catalytic composition can be effectively used as:

- **Adsorbent** in drying, purification or separation processes.
- **Ion exchanger**.
- **Catalyst** for chemical reactions, including:
    - o Catalytic cracking.
    - o Alkylation.
    - o Acylation.
    - o Isomerisation.
    - o Oligomerisation.
    - o Hydrocracking.
    - o Hydrotreating.
    - o Biomass transformation.
    - o Water Gas Shift reaction (WGS).
    - o Reverse Water Gas Shift reaction (RWGS).
    - o Methanol-to-hydrocarbons (MTH) reaction.
    - o CO_2 valorization reaction.
    - o Condensation reaction.

These new catalysts make it possible to use electrical energy to replace traditional heating in the chemical industry, which is currently carried out by burning fossil fuels (coal, gas and oil), with a more sustainable, cleaner and more efficient electrical system.

COLLABORATION SOUGHT

We are looking for companies interested in acquiring this technology for **commercial exploitation** through **patent licensing agreements**.

Company profile sought:

- Chemical industry.
- Pharmaceutical industry.
- Catalysis companies.
- Energy companies.