

# Nano and micro-zeolites synthesis by means of a spinning disk reactor.

## KEYWORDS

- ☐ ZEOLITES
- ☐ CATALYSTS
- ☐ SYNTHESIS
- ☐ NANOPARTICLES
- ☐ SDR

## AREA

- ☐ NANOTECHNOLOGIES & MATERIALS

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### Priority Number

n. 102020000007141\_03.04.2020.

### Patent Type

Patent for invention.

### Ownership

Sapienza Università di Roma 100%.

### Inventors

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### Industrial & Commercial Reference

Process and fine chemistry, biomedical,  
electronic.

### Time to Market

Pilot-scale tests are necessary before its  
industrialization (TRL 4).

### Availability

Research, Development e  
Experimentation.

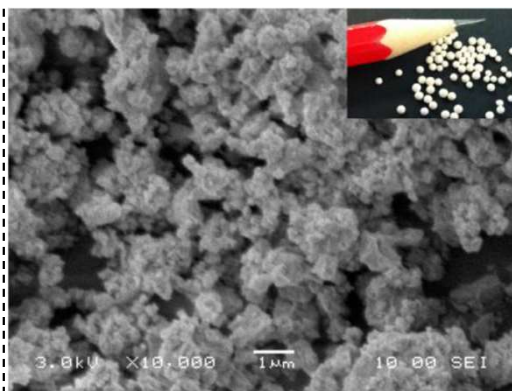
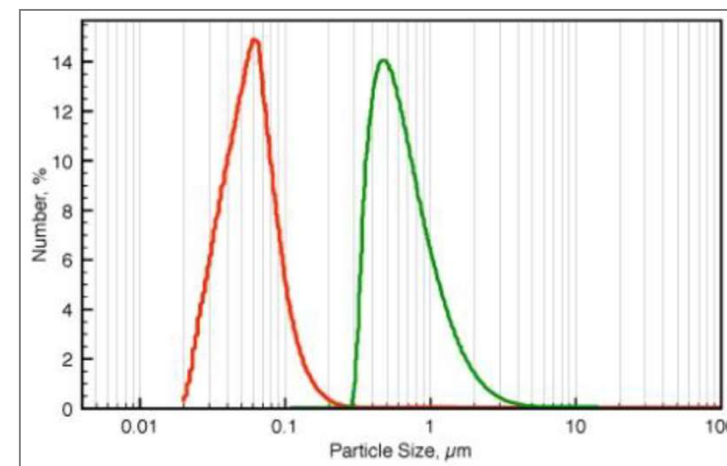


Fig. 1 SEM photo of micro-zeolites.

### Abstract

The present idea refers to an industrial production process with an SDR (Spinning Disk Reactor) which allows to produce nano or microstructured zeolites without the addition of other chemical agents for deposition, which should be removed with appropriate post-treatments and that make impossible the direct use of zeolites in biomedical applications. The process has the advantage of speeding up production compared to other systems and of decreasing the number of steps necessary to obtain a synthetic product characterized by high purity. A further advantage consists in the use of an SDR for continuous production, compatible with industrial practice.

Fig. 2 Comparison between micro and nanozeolites particle size distribution measured by granulometer.



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# Nano and micro-zeolites synthesis by means of a spinning disk reactor.

## Technical Description

The production of nano-zeolites can occur in two different ways: top-down through the miniaturization of natural zeolites and bottom-up through the preparation of synthetic zeolites. The bottom-up production that is proposed requires the use of a rotating disk reactor. In the particular case here examined, the reactor was equipped with a plastic disc. The speed at which the disc was brought was 1500 rpm by means of an electric motor connected to it. The reagent solutions are simultaneously injected on the surface of the disc, in the central point and at a certain distance from it respectively. The rotation of the disk guarantees the establishment of the necessary micro-mixing conditions in the liquid film in order to continuously produce nanoparticles

## Technologies & Advantages

The proposed process has the advantage of overcoming a classic discontinuous production of synthetic zeolites to continuous production, with all the related operative and economic advantages. First of all, a larger production rate of the product, greater reproducibility and purity, less production of process waste to be treated (in the specific case reduced to a minimum amount, since the liquid phase separated from the reaction product can be almost completely recirculated upstream of the process).

These characteristics of the proposed process differ greatly from those in use, which provide for the batch production of zeolites by means of microwaves in a reactor oven and which requires continuous loading, unloading and maintenance operations.

The use of an SDR then allows rapid industrialization of the process, as the reactor is easily scalable after performing experimental tests on a pilot plant.

## Applications

The present invention allows to produce nano or microzeolites characterized by a high purity, which can be used as heterogeneous catalysts in industrial chemical processes, for the production therefore of products of fine and pharmaceutical chemistry, in the medical and biomedical field, and in the electronics industry. The characteristic of the high purity and the possibility of obtaining these materials without the use of solvents or toxic chemical agents or difficult to separate from the reaction product, makes this product particularly interesting in biomedical applications, for instance as carrier of bioactive compounds in human/animal/plant cells.

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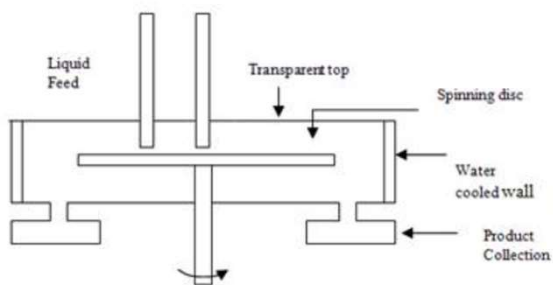


Fig. 3 Spinning Disk Reactor schematization.

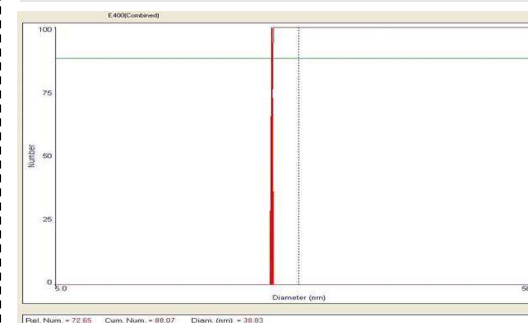


Fig. 4 PSD of nanozeolites measured by Dynamic Light Scattering.



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