SUPERCRITICAL FLUIDS AND MATERIALS TRANSFER UNIT

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The *"Supercritical Fluids and Materials"* Transfer Unit has been established to promote and transfer to industry recent developments in synthesis and materials processing using supercritical fluids. This technological Unit acts as an interface between industrial needs and research undertaken in the Institute of Condensed Matter Chemistry of Bordeaux in the field of supercritical fluids.

INTRODUCTION

Today, to become and remain competitive, companies need to be aware of new technological developments that take place in public research laboratories and have to exploit these developments for new products and processes. In the field of material processing, processes using supercritical fluids present a great opportunity, which may lead to new industrial applications, while responding to key challenges in the area of sustainable development. In this way the *"Supercritical Fluids and Materials"* Transfer Unit has been established to stimulate the use of supercritical fluids by industry and to help supercritical fluid technology transfer from laboratory to industry. This Transfer Unit is attached to the Institute of Condensed Matter Chemistry of Bordeaux (ICMCB) and serves as a gateway to the resources and expertise of this institute in the field of supercritical fluids. The main aims of this unit are to promote supercritical fluid technology for industrial applications and to provide technological services for materials processing using supercritical fluids.

TECHNICAL SKILLS AND ACTIVITIES

Supercritical Fluids have unique tuneable properties intermediate between gas and liquid, which can be adjusted continuously by modulating temperature and/or pressure. Due to these properties, supercritical fluid technology offers a large number of potential applications. The skills and activities of this Transfer Unit are mainly related to the field of material synthesis i.e. production of micronic and submicronic particles and also coating of nanometric particles. These two processes are based on chemical transformation of metallic precursors in supercritical fluids. Depending on the supercritical media, it is possible to obtain nanometric to submicronic powders of metals, oxides and nitrides [1-4] such as Cu, Ni, TiO_2, Fe_2O_3, Cr_2O_3, Al_2O_3 or Cu_3N. It is also possible to obtain metal, oxide or nitride coating on

nanometric particles [5,6]. One of the main advantages of these processes is to obtain dry powders in a single step thus avoiding filtration problems.

An example of micronic particle synthesis is shown figure 1 where Cu particles have been obtained in a CO_2/ethanol supercritical mixture. The size and morphology of these particles can be tailored depending on experimental parameters.

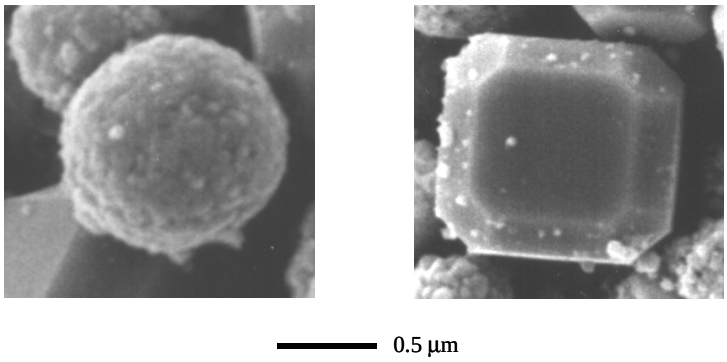

Figure 1: Cu particles a) aggregation of nanostructures; b) crystalline growth

An example of coating of micronic particles using supercritical fluids is shown figure 2 where Ni particles have been successfully coated with copper in a CO_2/ethanol mixture.

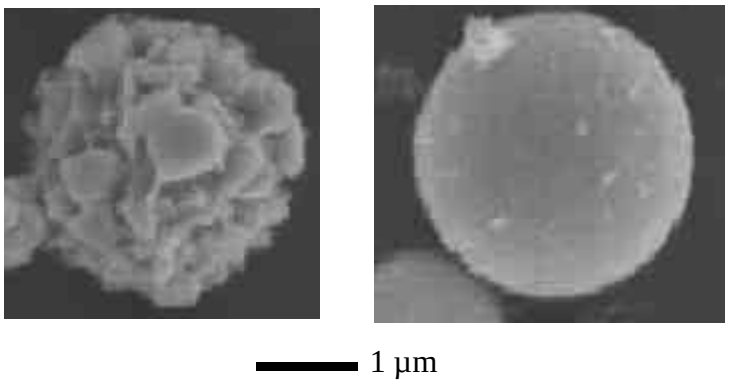

Figure 2: a) Ni particles before coating; b) Cu coated Ni particles

In a more general approach, this transfer unit is involved in all processes using supercritical that bring response to technological problems met by companies in the field of materials processing (extraction, cleaning, drying,…).

TECHNICAL MEANS

Our technical means enable us to provide services such as new product feasibility assessment and pilot plant validation at the laboratory scale. To do this, the Transfer Unit has batch reactors with capacity from 5 to 300 cm^3, two pilot plants with flow rate of 3 kg/h and 20 kg/h for powder synthesis and powder coating (operating conditions up to 30 MPa and 250°C) and a pilot plant for supercritical fluids extraction equipped with a CO_2 recycling system (flow rate of 20 kg/h).

CONCLUSION

The *"Supercritical Fluids and Materials"* Transfer Unit provides technical services answering industrial needs in the field of material processing. These services contribute to new product developments and/or process improvements in terms of quality and environmental aspects.

ACKNOWLEDGMENTS

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