Crystals and some uses…

Bone replacement crystals

Studies of the chemical composition of bones and tooth enamel were quite perplexing for the first researchers. These chemical compounds are very reactive nano-crystals known as apatites. By means of artificial biomineralization, Man has been able to create crystalline prostheses which imitate nature.

Crystals for pharmaceutical applications

The same molecule can crystallise in different forms while presenting the same chemical characteristics in solution. This polymorphism results from a different arrangement of molecules. In pharmacy, it is important to control the shape and size of the crystals that contain the active molecule of the medicine, because these parameters may influence the dissolution rate and thus have an effect on the effectiveness of the medicine.

Crystals and their defects in metallurgy

Metallurgy is the study of metals, intermetallic compounds and mixtures known as alloys. Metals and alloys are made up of many crystals and are polycrystalline solids. They have numerous uses ranging from steel in construction, to complex alloys used in modern jet engines, to coating that confer corrosion resistance. Even if hardness can be associated with certain structures, it is often the defects in metals and alloys that determine their very useful mechanical properties.

Liquid crystals!

A liquid crystal is a phase between the liquid and the solid state: it flows like a liquid but has the properties of a solid. The molecules of a liquid crystal are highly elongated and have the tendency to line up like matches or cigars in a box. They owe their name to their optical properties which are similar to those of regular crystals.

How to mend broken bones?

Bone reconstruction in humans is difficult, sometimes making use of surgical bone grafts is necessary. However, the difficulties associated with finding grafts from the patient, and the potential risks of viral transmissions raised by foreign transplants (human or animal), lead scientists to consider the creation of synthetic bone substitutes. Recent work shows the importance of biomaterials that influence bone growth and mineralization.

Polymorphisms of crystals give them distinct properties that may be important in pharmacy:

- Different distributions of faces of the crystals: for example, in the acid L-asparagine, certain solvents influence the formation of polymorphic forms, sticking onto one facet of growth without disrupting the assembly of molecules in the crystal.
- Different density and porosity with consequences for the assembly of the drug.
- Solubility and dissolution rates modify the bioavailability of the drug with a risk of either under-dosing or toxicity.

Source: J. Doucet-LPS-Orsay