

Ejemplos de experimentos realizados en el Sincrotrón ALBA

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Sincrotrón ALBA: alta tecnología al servicio de las empresas

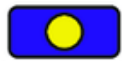


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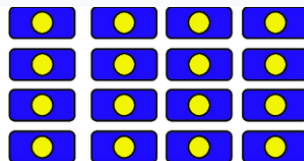
Producing better chocolate



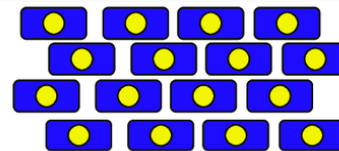
Chocolate



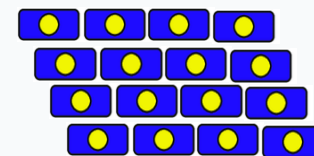
Molecule



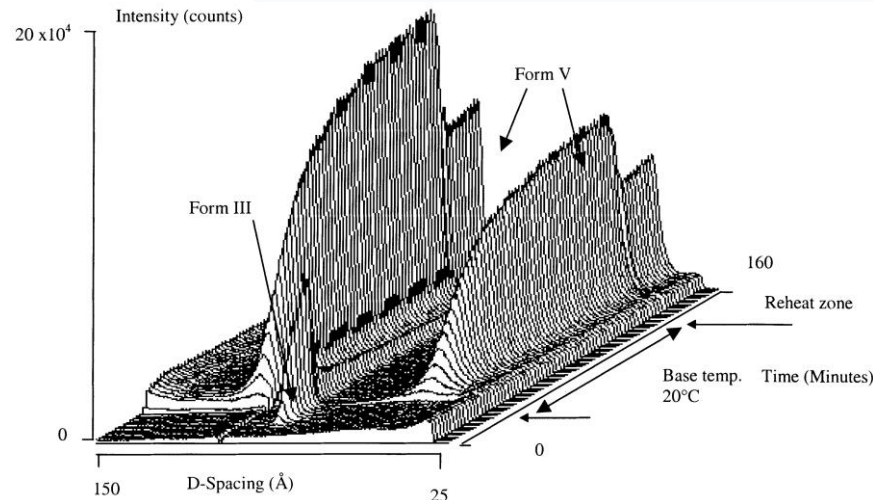
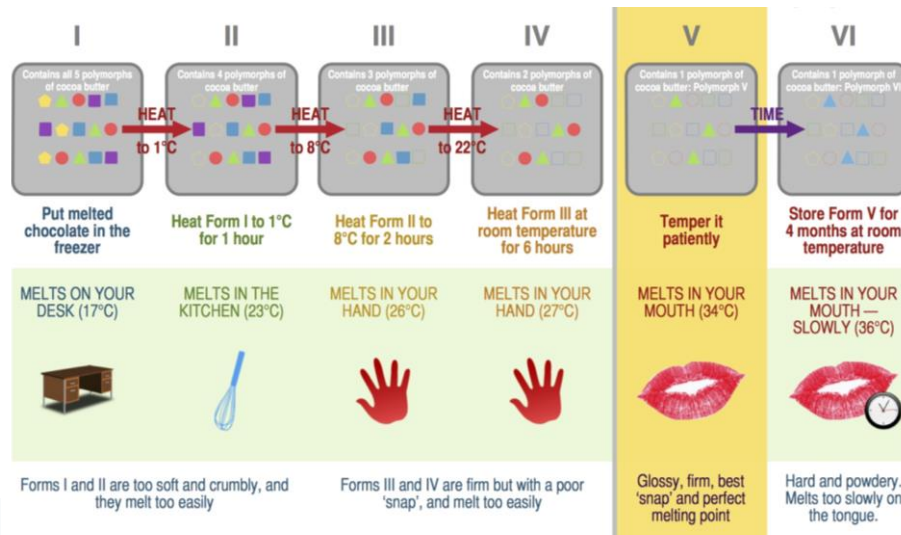
Polymorph A



Polymorph B



Polymorph C

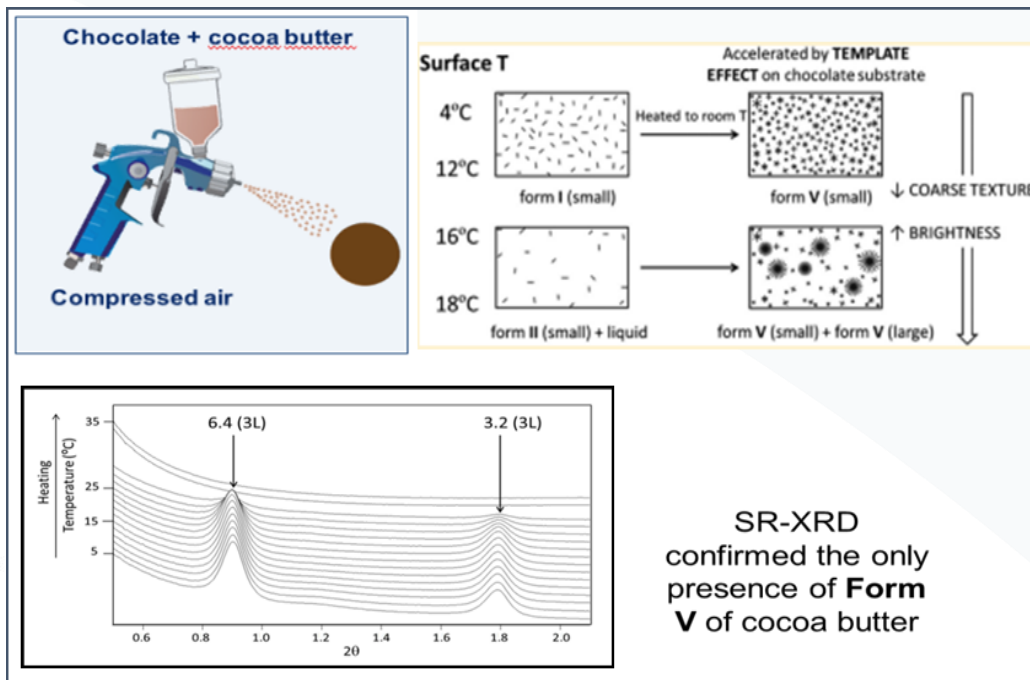
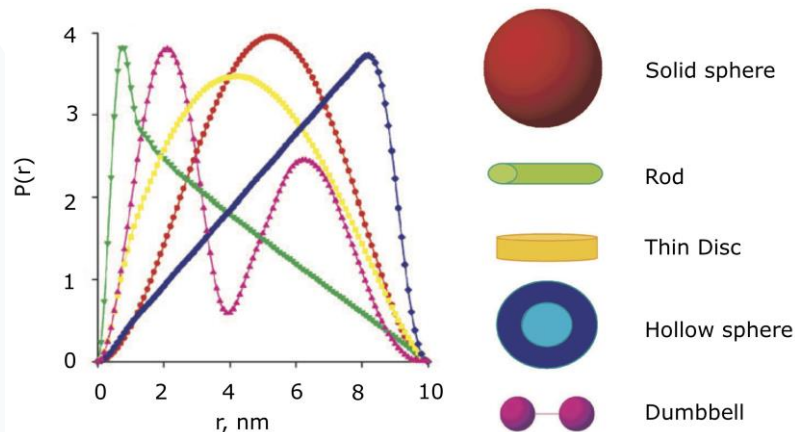


□ The data obtained here helped Cadbury to determine the optimum conditions for good tasting chocolate manufacturing.

Chocolate with velvet texture

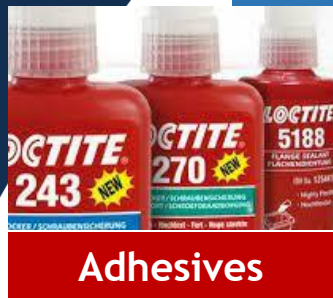


Chocolate



❑ The velvet effect is caused by the formation of large and small crystals of form V and enhanced when using low temperature and low cooling rates

Real time crystallization of adhesives



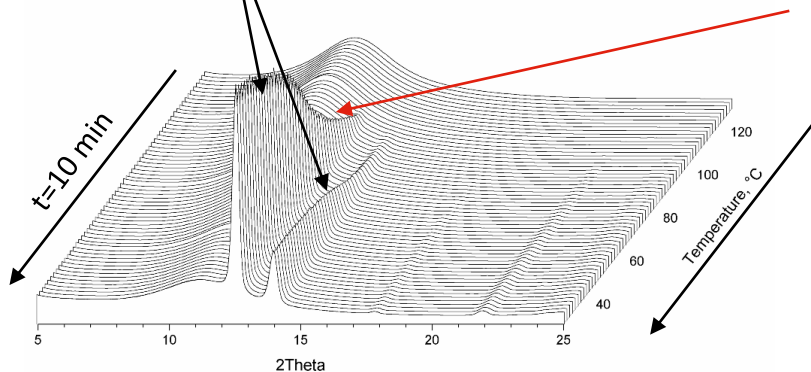
Adhesives



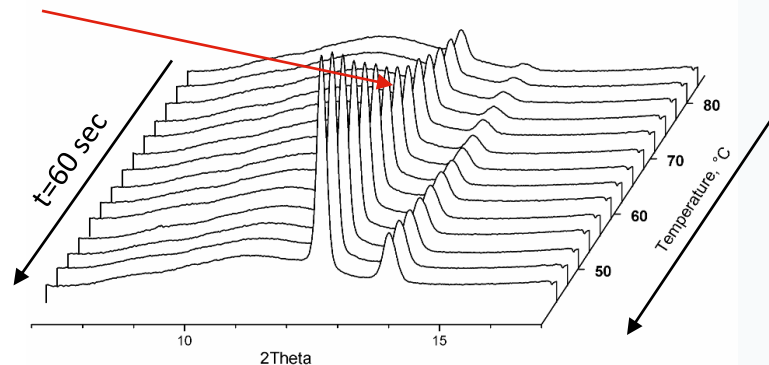
Crystallization kinetics is one of the critical performance parameter for adhesives (deposition temperature, speed of setting, bond strength).

Adhesive and additive crystalline peaks

- Time-resolved x-ray diffraction from Henkel adhesive formulation
- Data shows that crystallization accelerates at a certain temperature, driven by a special additive.



NSLS (X27C beamline): 10 sec/pattern, can monitor 10 °C/min cooling rate



ALBA (NCD beamline): 5 sec/pattern, can monitor ~40 °C/min (!) cooling rate

❑ Using synchrotron WAXS, one can directly monitor, in real time, how crystallinity develops in an adhesive, at realistic cooling rates.

Mechanical properties of polymers



Plastics

Renewable sources to produce polymers are being extensively tested
The mechanical properties of these biopolymers is crucial

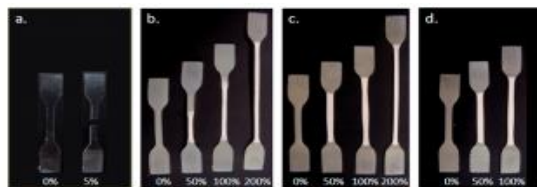
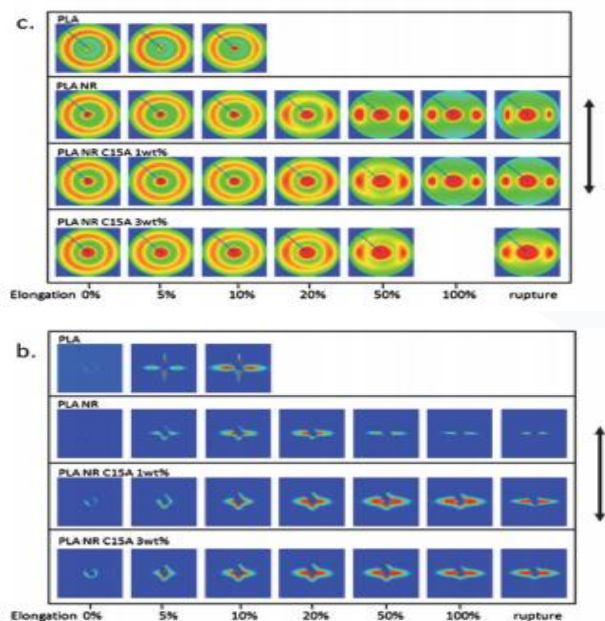


Fig. 4 Samples stretched at different elongations (a) PLA, (b) PLA/NR, (c) PLA/NR/C15A 1 wt%, (d) PLA/NR/C15A 3 wt%.



□ PLA is a brittle material due to failures through crazes. PLA/NR is ductile as it forms voids when stretched. PLA/NR/C15A bionanocomposites generate crazes that allows polymer chain orientation and elongation.

Effect of cosmetics on collagen

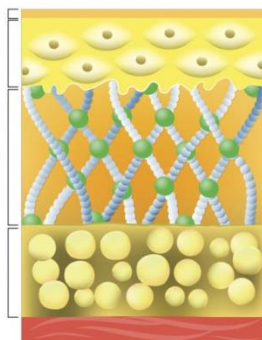


Skin care

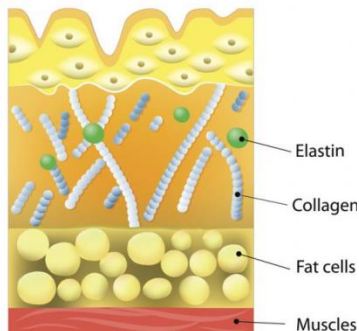
bicosome®

Epidermis
Dermis
Hypodermis

YOUNGER SKIN

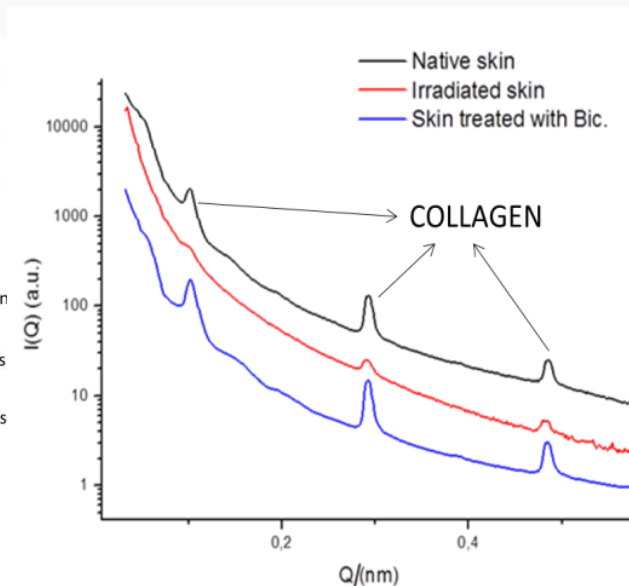


AGING SKIN



Collagen structure is an indicator of the skin state.

The more ordered is collagen, the more elasticity has the skin



❑ After the application of the regenerative product, collagen skin recovers its structure.

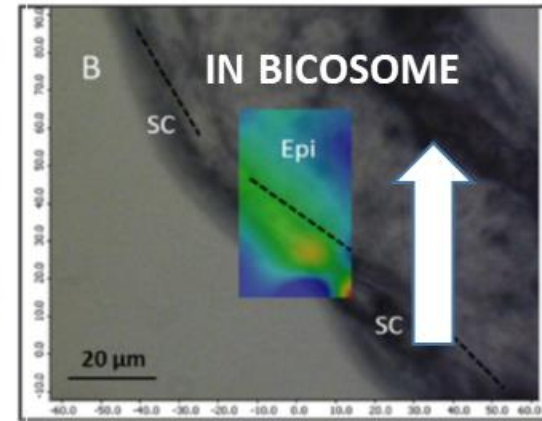
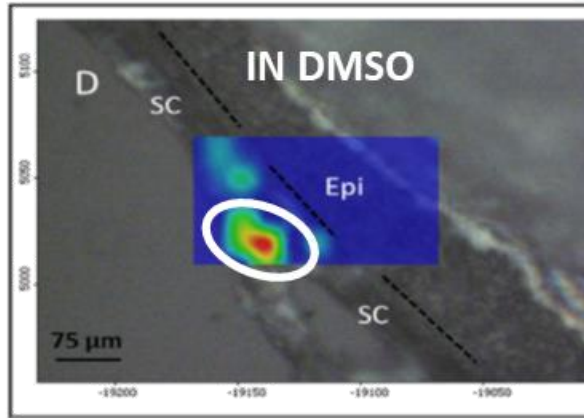
Penetration of cosmetics on the skin



Skin care

bicosome®

The skin acts as a barrier between the organism and the environment.
Rhenium tris-carbonyl derivative vs RTCD inside bicosomes.



Epi-epidermis

SC-stratum corneum

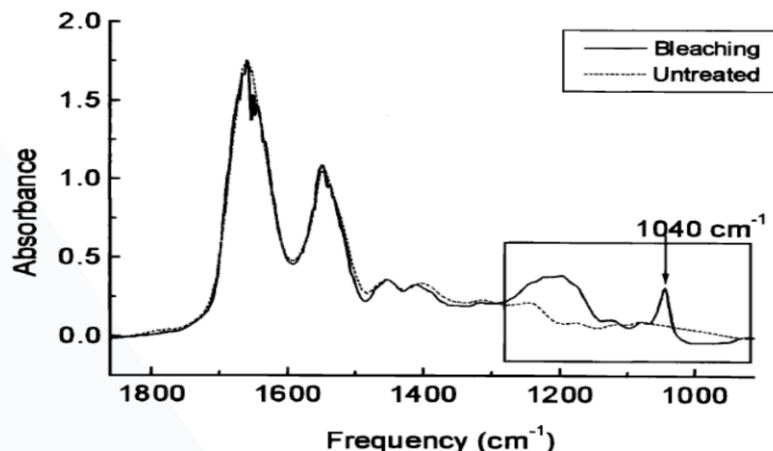
□ FTIR microspectroscopy allowed to see the penetration of products on the skin.

Effect of products on the hair

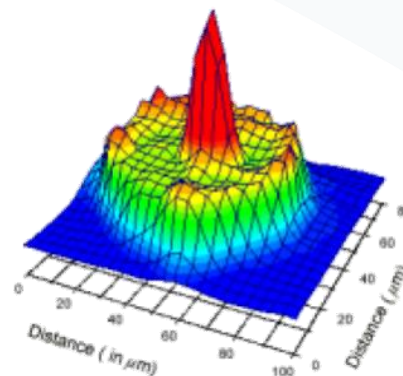


Hair care

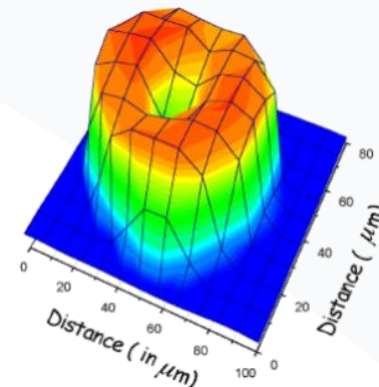
High resolution synchrotron IR allows to study the biochemical composition of human hair (lipids, proteins and DNA) in the cuticle, cortex and medulla substructures



Lipid Profile



Protein Profile



SR-FTIR microspectroscopy allows to determine the effects of products, pollutants, damaging... on hair

Improvement of the color properties of pigments

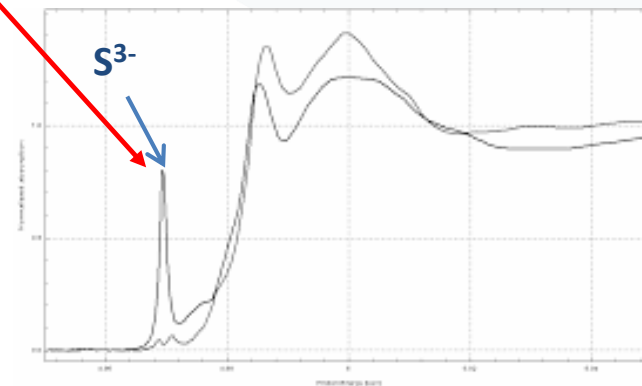
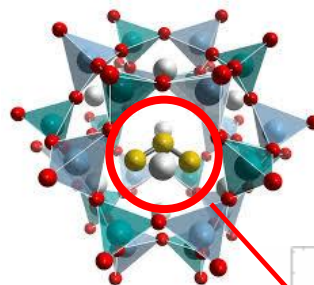
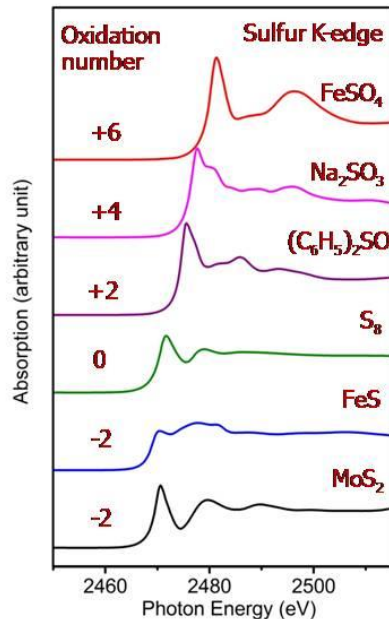


Ultramarine blue



Sulfur species into aluminosilicate cage can be S^{3-} , S^{2-} , S_4 , S , SO_4^{2-} ...

The higher the amount of the S^{3-} species the better the color parameters.



□ The information obtained helped them to improve the production process.

Enhancing food shelf life through packaging

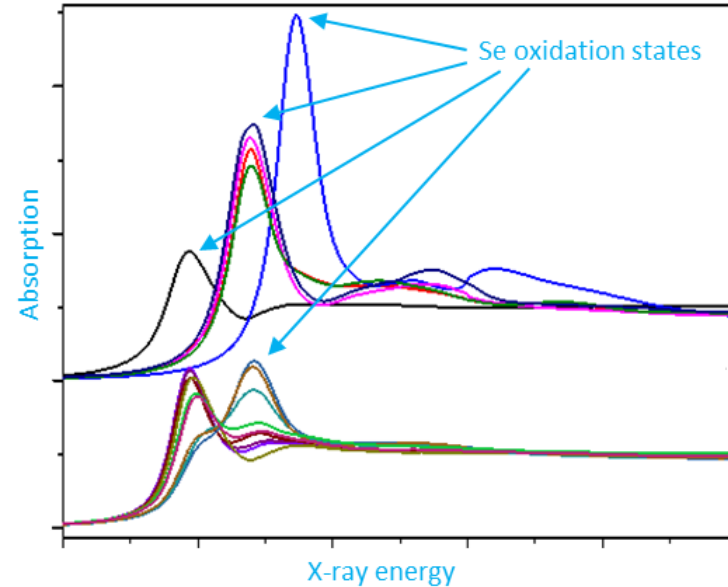


Multilayer
packaging



The new multilayer system that contains Se(0) nanoparticles.

Selenium(0) absorbs free radicals and prevents food from oxidation but Se^{+2} or Se^{4+} do not.



□ The measurements allow them to see which of the packaging measured had the highest amount of Se(0).

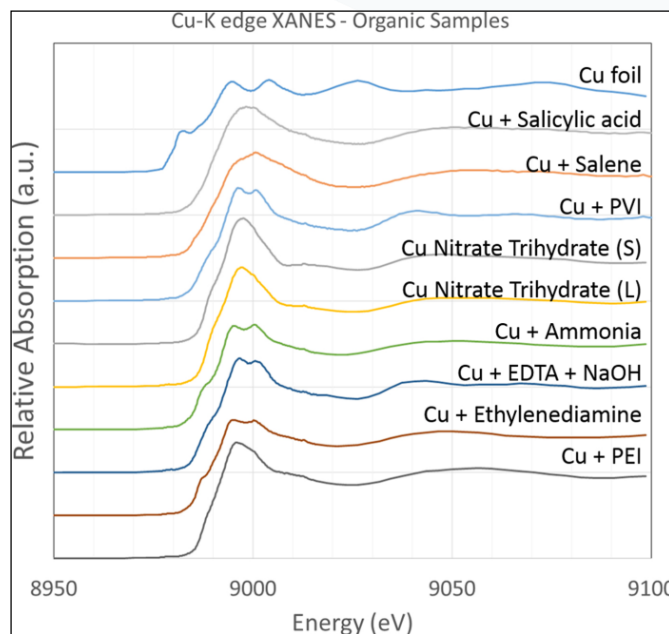
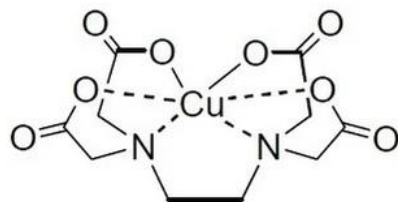
Slow release of Cu(II) for plants



Agriculture

Copper (II) is an essential micronutrient that acts as a growth stimulator.

However, too many Cu can be lethal for the plants



□ The amount of Copper complexed produced for the slow release of Copper to plants can be determined.



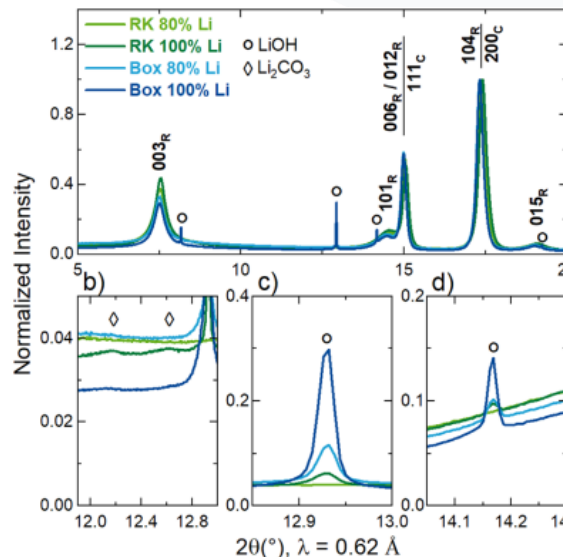
Energy



We create chemistry

Comparison between the composition of lithium batteries prepared with a novel two-stage methodology and the conventional method.

The efficiency of the novel methodology increase by a factor of three.

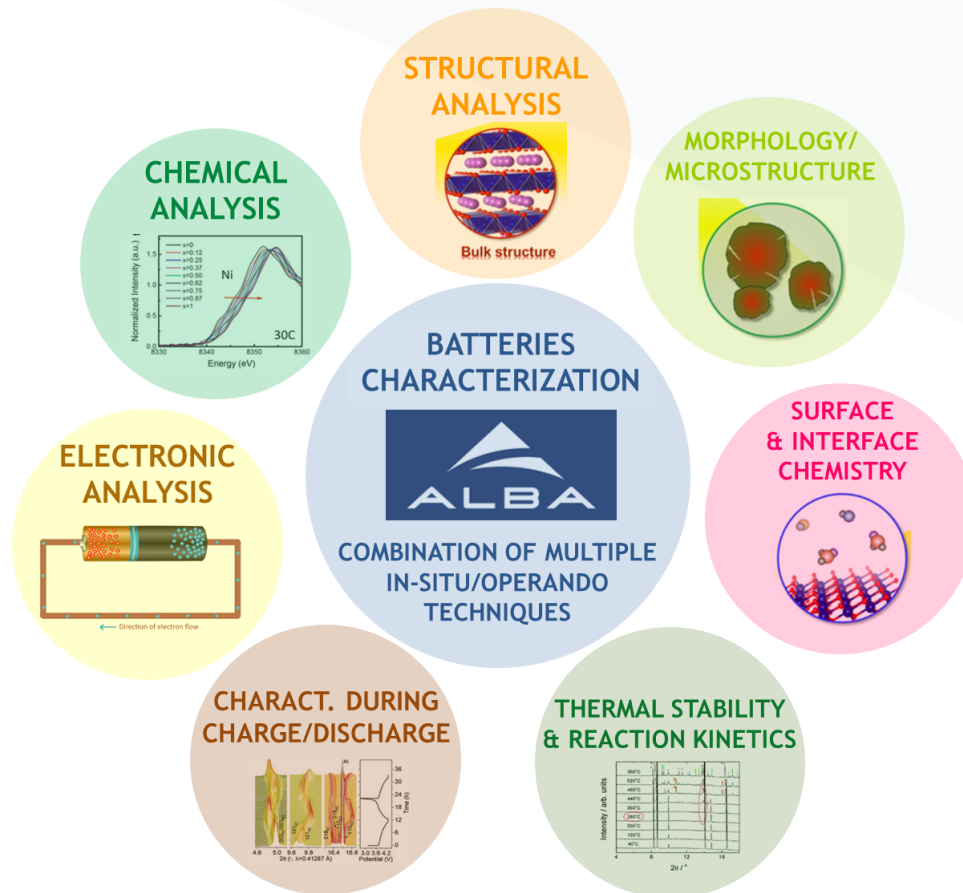


❑ The novel methodology obtains complete oxidation to Li_2CO_3 whereas the conventional method still presents LiOH.

Battery materials characterization



Batteries
industrial
workshop
26th April!!!



INDUSTRIAL APPLICATIONS



ALBA
SYNCHROTRON

FOOD AND PACKAGING



WHAT INFORMATION CAN BE OBTAINED?

- Dynamics and stability of food emulsions.
- Phase transitions in fat and rheological act carbohydrate food.
- Determination of toxic chemicals including fish, legumes and vegetables.
- Identification of chemical elements and spec food for designation of origin purposes.
- Study of structural changes in plastics used storage of products.
- Determination of copper and other metals at their different oxidations steps.
- Chemical imaging of plants, seeds, grains,

WHAT ALBA DOES



HELPING TO DESIGN F
The ingestion of selenium to prevent cardiovascular metabolism of selenium by following the different determine the best meth



HAM CURING PROCESS
Cured hams from different were characterised in or traceability. The evolution at different times during results enabled Spanish



HOW TO OBTAIN THE V
The crystallisation of van ALBA using chocolate at The results demonstrate 16 °C, a velvety texture v and this texture improve

HEALTH



WHAT CAN BE STUDIED?

- ♥ PRODUCTS FOR PERSONAL CARE AND HYGIENE
- ♥ COSMETICS
- ♥ DENTAL MATERIALS
- ♥ EMULSIONS, FOAMS AND GELS
- ♥ BIOLOGICAL TISSUES
- ♥ CELLS AND BIOLOGICAL PROCESSES
- ♥ BIOMATERIALS FOR BIOCOMPATIBLE IMPLANTS
- ♥ BIODEGRADABLES FOR DRUG ADMINISTRATION

WHAT ALBA DOES



ANALYZING ALZHEIMER'S MECHAN
Aggregates of different proteins are suffering Alzheimer. Location and eff neuronal cells have been studied at AL Alzheimer's mechanisms, to better disease and eventually to prevent its c



ESSENTIAL OILS
Essential oils are widely used as natural preparations. Different vesicles used a in the ALBA synchrotron. Results show in the vesicles without altering their s of the vesicles to release essential oils



SKIN CARE COSMETICS
X-ray synchrotron diffraction makes it structure of collagen present in the sk that infrared rays produce disorganised effect can be prevented by using bilipid to address new formulations to protect

WHAT INFORMATION CAN BE OBTAINED?

- Study of the structural environments such as
- Characterisation of chemical products times after applica
- Structural information and adhesives for d
- Determination and tissue (muscles, lig
- 3D reconstruction of cellular mechan
- Structural studies of f

PHARMACEUTICAL



WHAT INFORMATION CAN BE OBTAINED?

- Structural information of the interactions between a drug and a therapeutic target at the atomic level.
- Detection and quantification of crystalline phases present in small amounts in a pharmaceutical formulation.
- Detection of impurities and polymorphism studies. Crucial information for intellectual property protection and patent infringement.
- Determination of oxidation states of compounds in drugs.
- Determination of the structure of a drug at the atomic level, including chirality and absolute configuration.
- Penetration of drugs and pharmaceutical formulations in biological tissues such as the skin.
- 3D reconstruction of cells and cellular material to visualise the effect of diseases and drugs in the cell with minimal sample treatment. Innovative strategies for disease treatment.

WHAT ALBA DOES



DETECTION OF VERY LOW AMOUNTS OF COMPOUNDS IN DRUGS
Some compounds exist in very low concentrations in drugs and may only be detected using synchrotron techniques. The detection and identification of crystalline phases, compounds or polymorphs present in small quantities in drugs have been carried out at ALBA. This information may be crucial for drug development and intellectual property protection.



A 3D MAP OF THE HEPATITIS VIRUS ALTERATIONS IN CELLS
A 3D image of an entire cell infected with the hepatitis C virus (HCV) close to physiological conditions was observed for the first time using ALBA's innovative full-field transmission microscope. The structural alterations in the cell induced by the HCV and repaired by specific antivirals was visualised, proving to be a valuable method for checking drug effectiveness and understand complex biological processes.



A DRUG TO COMBAT MALARIA
Malaria is an infectious disease transmitted by a mosquito bite that causes more than one million deaths every year. Macromolecular structural studies at the atomic level performed at ALBA revealed the structure of a new antimalarial drug linked to DNA, covering specific areas that prevent the typical development of the parasite and cause its death. This research may significantly contribute to the effective treatment of malaria.

ALBA



- ✓ ALBA, a cutting-edge facility at the service of the scientific and industrial community
- ✓ It provides structural information on a large number of materials in working conditions.
- ✓ Many companies have already used ALBA Synchrotron techniques - don't miss this OPPORTUNITY to improve your products too!

industrialoffice@cells.es

THANK YOU!

