Electron crystallography of nanoparticles

Doctorant·e
CORDERO OYONARTE Erica

Direction de thèse
BOULLAY Philippe (Directeur·trice de thèse)

Date de la soutenance
07/11/2024 à 10:00
Lieu de la soutenance
CRISMAT - ENSICAEN Batiment G

Rapporteurs de la thèse
CALDÈS MARIA TERESA Institut des matériaux Jean Rouxel
ROUSSEL PASCAL ECOLE NATIONALE SUPERIEURE de CHIMIE

Membres du jurys
BOULLAY Philippe, , ENSICAEN
CALDÈS MARIA TERESA, , Institut des matériaux Jean Rouxel
GONZALEZ CALATAYUD DAVID, Maître de conférences, Universidad Autonoma de MADRID
PRALONG Valerie, , Université de Caen Normandie (UCN)
ROUSSEL PASCAL, , ECOLE NATIONALE SUPERIEURE de CHIMIE

Abstract
Nanoparticles (NPs) are of great interest due to their unique properties, making them useful in different scientific fields. Understanding the crystallographic structure of NPs is crucial for uncovering their distinct characteristics and designing new materials. Single Crystal X-ray Diffraction is employed for accurate crystal structure determination; however, it is limited by the small size of NPs. Powder X-ray Diffraction (PXRD serves as an alternative for phase identification and average particle size, but it has limitations in structure refinement due to peak broadening and overlapping. In particular, 3D Electron Diffraction (3D ED) techniques have revolutionized the field, enabling detailed structural analysis of very small crystals. This work aims to test the limits of 3D ED for analyzing the structure of inorganic nanoparticles as small as 10 nm using various protocols, such as precession-assisted 3D ED, continuous rotation 3D ED, and serial ED. It also explores the potential of 3D ED compared to PXRD and its application to various structural characterization challenges in NPs, including the detection of light atoms, refinement of mixed occupancies, and solving complex unknown structures