Title: Enhancing Electrical Properties through Crystallization of Sodium Phosphate Glasses

Presenting author: Imane CHAIBOUB is with ENSAM Meknes, Moulay Ismail University, Meknes, Morocco. Faculty of Sciences Ben M'sik, University Hassan II of Casablanca, Morocco. (e-mail: imanechaiboub3@gmail.com).

Co-authors: Abdeslam El BOUARI is with Faculty of Sciences Ben M'sik, University Hassan II of Casablanca, Morocco.

Lahcen BIH is with ENSAM Meknes, Moulay Ismail University, Meknes, Morocco.

Abstract: In recent years, there has been significant attention directed towards storage technologies for their potential applications. The quest for energy storage devices that are efficient, sustainable, and cost-effective has driven the exploration of next-generation batteries. Among these, all-solid-state sodium batteries (ASSSBs) have emerged as promising contenders to replace lithium-ion batteries for large-scale energy storage, owing to the abundance of sodium, safety, affordability, and eco-friendliness. Nevertheless, the advancement of solid electrolytes with both high ionic conductivity and stability remains a key challenge. This study delves into the influence of glass crystallization on improving electrical properties and assesses the suitability of sodium phosphate-based glass-ceramics as effective ionic conductors. Employing a melt-quenching method, glassy samples were elaborated and subsequently crystallized under specific heat treatment conditions determined using Differential Scanning Calorimetry (DSC) measurements. The resulting glass-ceramics underwent comprehensive structural, microstructural, and electrical analyses, including X-ray diffraction (XRD), infrared (IR), Raman spectroscopy, scanning electron microscopy (SEM), and electrochemical impedance spectroscopy (EIS). Findings indicate that the glass-ceramic demonstrates enhanced sodium ionic conductivity compared to the pristine glass, along with notable thermal stability.

***Keywords*:** Crystallization; Glass-ceramics; Ionic conductivity; Sodium phosphate glasses.

Imane CHAIBOUB is a dedicated and passionate Ph.D. student specializing in science and technology, in the Laboratory of Physical Chemistry, Materials, and Catalysis (LCPMC) at the Faculty of Sciences Ben M'Sick, Hassan II University of Casablanca, Morocco. My research aims to explore new materials, glasses, and glass-ceramics, investigating their microstructural and electrical properties for use as solid electrolytes in sodium batteries for energy storage applications.