**ABSTRACT - ORAL**

# Development and Characterization of Porous Geopolymers for Energy Storage Application

*Camille ZOUDE[1], Elodie PRUD'HOMME[2], Kévyn JOHANNES[3], Laurent GREMILLARD[2]*
*[1]Belgian Ceramic Research Centre, Av. du Gouverneur E. Cornez 4, Mons B-7000, Belgium*
*[2]INSA Lyon, Université Claude Bernard Lyon 1, CNRS, MATEIS, UMR5510, 69621 Villeurbanne, France*
*[3]INSA Lyon, Université Claude Bernard Lyon 1, CNRS, CETHIL, UMR5008, 69621 Villeurbanne, France*

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With the increasing importance of energy management, thermochemical energy storage systems are emerging as a promising solution, particularly those combining a porous host material with hygroscopic salts. These high-energy-density systems rely on a reversible reaction: dehydration is endothermic, while hydration is exothermic. Geopolymers stand out as excellent candidates for host materials due to their mechanical properties, ease of processing, and low cost. However, their porosity requires optimization for effective application.

To address this, three strategies have been developed: (i) **direct ink writing**, which enables precise control of porosity through filament spacing, (ii) **chemical foaming**, which generates internal porosity within the paste, and (iii) **a combination of both techniques**, allowing for multi-scale porosity optimization. These methods make it possible to achieve adjustable porosity levels (up to 71%) and control pore access diameters ranging from millimeters to micrometers. The impregnation of hygroscopic salt into the matrix enables energy storage through chemical and physical sorption, with energy densities reaching **61 kWh·m$^{-3}$**. Different perspectives are being considered to further improve these performances.