

## Poster Presentation

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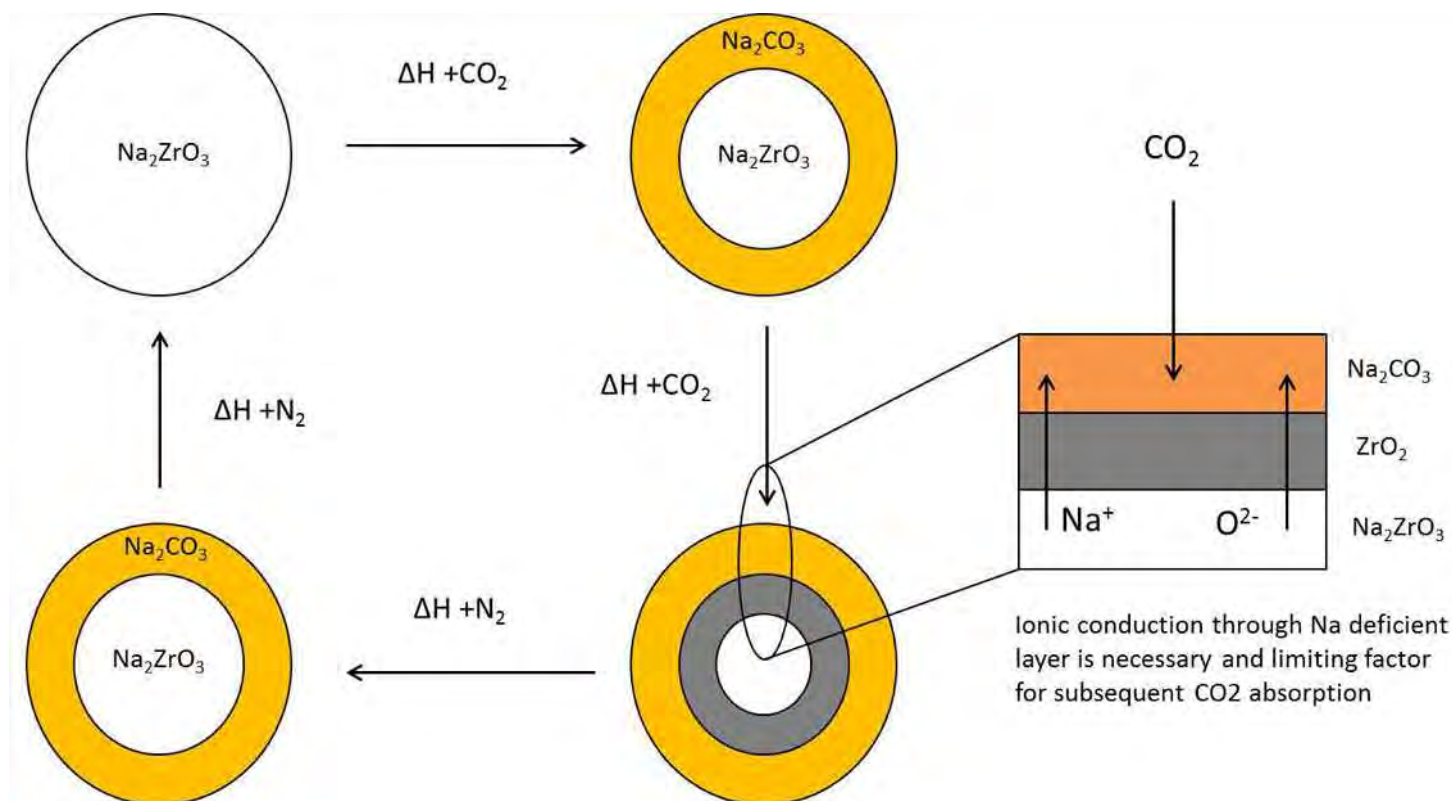
### Metal oxide materials for high temperature CO<sub>2</sub> sorption studies

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In recent years, a number of novel ceramic oxide materials have emerged that are capable of absorbing CO<sub>2</sub> at high temperatures (>500C) while remaining stable over a large number of cycles and a wide range of temperatures [1]. The most promising are been considered for carbon capture applications – specifically, for use in combustion chambers and the smoke stacks of power plants where combustion gases which contain primarily a mixture of CO<sub>2</sub> and N<sub>2</sub> at high temperature. Compared to other CO<sub>2</sub> sequestration technologies, these ceramics have some advantages (eg. chemisorption at high temperatures) and disadvantages (eg. limited kinetics over time) [3]. Examples of oxides already known to show significant CO<sub>2</sub> absorption include Li<sub>5</sub>AlO<sub>4</sub>, Li<sub>6</sub>Zr<sub>2</sub>O<sub>7</sub>, Na<sub>2</sub>ZrO<sub>3</sub> and Ba<sub>4</sub>Sb<sub>2</sub>O<sub>9</sub>. The phase formations and structural evolution of these metal oxides have been studied under environmental conditions mimicing those found in combustion chambers and power plants, over the temperature range 873–1173 K. CO<sub>2</sub> absorption by these materials is believed to proceed through a layering effect of the sorbent material, explained through a core-shell model (see figure). Each phase is represented as a layer covering a particle, with the outermost layer exposed and allowed to react with the environment. Detailed studies into the mechanism of CO<sub>2</sub> absorption and the material layers will shed more information that can be used to fine tune the materials to increase their CO<sub>2</sub> absorption capacity. Previous work has focused on the identification of phases ex situ and studies of their practical absorption capacity and kinetics. The new work we will present here uses a combination of a x-ray spectroscopy, x-ray and neutron diffraction, to understand both how the sorption process works and how the structural evolution of the phases affects the CO<sub>2</sub> sorption of the materials over time in-situ.

[1] Nair, B.N., Burwood, R.P., Goh, V.J., Nakagawa & Yamaguchi, K.T, *Progress in Materials Science*, 2009, 54, 511–541, [2] Choi, S., Drese, J. H., Jones, C. W., *Chem.Sus.Chem*, 2009, 2, 796, [3] Favre, E. *Journal of Membrane Science*, 2007, 294, 50–59



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