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In situ characterization of ceria-based redox materials for solar thermochemical H2O and CO2 splitting

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The main limitations to the widespread deployment of solar energy technologies have historically been their limited reliability and storage-related complexities. These correlated issues have been recently addressed through the development of solar-driven redox thermochemical cycles based on metal oxides, probably the most studied of which has been the Zn/ZnO cycle. All of them are based on a high-temperature endothermic reduction step employing concentrated sunlight, followed by a lower-temperature exothermic oxidation step closing the cycle. The concept is then to store the reduced material and reoxidize it whenever needed, for instance producing fuels. In this regard promising opportunities have been offered by a CeO2-δ redox cycle which exploiting the high O diffusivity and non-stoichiometry of this material ensures several technical and efficiency-related advantages over other cycles.
This master thesis is then oriented toward the development and improvement of characterization techniques aimed to reach a deeper understanding of the processes involved in different Ce1-xMxO2-δ redox cycles and thus possibly to enable better-tailored chemical designs.

Primary author: Mr SALA, Simone (MaMaSELF)

Presenter: Mr SALA, Simone (MaMaSELF)

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