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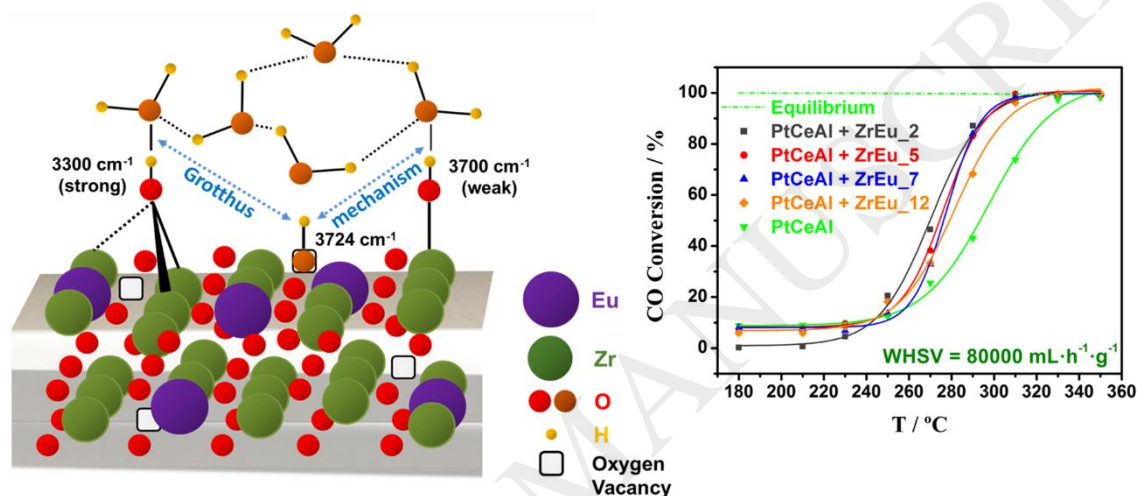
A direct *in situ* observation of water-enhanced proton conductivity of Eu-doped ZrO₂: effect on WGS reaction

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Graphical abstract



Highlights:

- Proton conductivity reveals an optimal dopant amount of 5 mol.% of Eu₂O₃ in ZrO₂.
- *In situ* spectroscopies demonstrate water conductivity by Grotthuss' mechanism.
- WGS reaction performance is enhanced by a proton conductor for water activation.

Abstract

Eu-doped ZrO₂ solid solutions have been synthesized in order to prepare proton conductors as water-enhancer additives for the WGS reaction. Elemental characterization has been carried out revealing homogeneous dopant distribution resulting in fluorite-type solid solutions for Eu₂O₃ contents up to ~9 mol.%. Representative samples of the Eu-doped ZrO₂ series have been analysed by Impedance Spectroscopy (IS) in inert, oxygen and wet conditions. The solid solution with 5 mol.% of Eu₂O₃ has presented the highest conductivity values for all tested conditions indicating an optimal amount of dopant. Moreover, the presence of vapour pressure results in an increment of the conductivity at temperatures lower than 300 °C, meanwhile at higher temperatures the conductivity is the same than that in inert

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