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Activity of cerium oxide thin films prepared by atomic layer deposition using custom and commercial precursors

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Atomic layer deposition (ALD) allows preparation of conformal coatings with possibility to control their thickness at the submonolayer level, making it a good tool for depositing active layers on 3D structures. Our group is working on cerium oxide-based materials for hydrogen detection, which is difficult at ambient conditions due to the low sensitivity and long response time of the sensors. The cerium oxide layers prepared by ALD contain a lot of defects and provide an opportunity to overcome these complications. Thickness and morphology of the oxide films play an important role in defining the Ce³⁺/Ce⁴⁺ ratio, as well as the interface with the used substrate. Here, we compare cerium oxide thin films deposited by ALD techniques on SiO₂ and Al₂O₃ substrates. The results reveal that the interface to the substrate can considerably influence the reactivity of the cerium oxide toward hydrogen and oxygen. Preparation of the oxides using two different precursors (commercial Ce(thd)₄ and custom Ce(dpdmg)₃) has been demonstrated to affect the redox properties of the films, their reactivity, and the reversibility.

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