Single crystal studies to evaluate the structure sensitivity of the Oxygen Evolution Reaction (OER) under acidic conditions

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From fundamental point of view, the Oxygen Evolution Reaction (OER) is the decisive process in electrolysers. The efficiency of the device is mainly limited by this reaction, which exhibits a large overpotential on all known catalysts. Over the last years many efforts have been addressed to develop more stable and active catalysts. However, most of these studies involved nanostructured catalysts deposited on different types of supports, while just a few works tried to understand the fundamentals of this reaction. Such investigation can be used to improve actual catalysts, but they are also an important link between theory and experiment. One of the main issues that still wait to be experimentally explored is the structure sensitivity of the OER. Usually such studies are done with single crystal electrodes of different surface orientations. However, there are many drawbacks in the use of this approach for studying the OER. The main challenge is that the surface loses its order once overpotential is driven to higher values and metal oxides start to form. This process is inevitable since the oxide is an intermediate in the reaction mechanism, while surface reorganisation cannot be easily avoided. Despite these intrinsic limitations, we have been able to retain structural information developing an investigation approach based on electrochemical and spectroscopic techniques. This approach allowed us to investigate the structure sensitivity of the OER on Pt single crystals and hopefully soon can be applied to more relevant systems.