# Tuning the activity of cobalt 2-hydroxyphosphonoacetates-derived electrocatalysts for water splitting and oxygen reduction: Insights into the local order by pair distribution function analysis

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Electrode materials generally exhibit complex heterostructures wherein both amorphous and crystalline phases may coexist [1]. Advanced techniques, such as Pair Distribution Function (PDF) analysis, may offer valuable structural insight into the local order and domain sizes of the active phase present in these materials.

Herein, cobalt pyrophosphate- and phosphide-based electrocatalysts were prepared from the corresponding metal (R,S)-2-hydroxyphosphonoacetates by pyrolysis in $N_2$ and 5%-$H_2$/Ar at different temperatures (500 – 800 ºC) [2]. Their electrocatalytic performances toward the hydrogen and oxygen evolution reactions (HER, OER) and oxygen reduction reaction (ORR) were compared with those resulting from the N-doping and P-enrichment of the electrocatalysts. In addition, differential PDF (d-PDF) analysis of the spent electrocatalysts revealed that, regardless the amorphous or crystalline nature of the metal pyrophosphate/phosphides obtained, all of them transformed into biphasic cobalt oxy(hydroxydes) under tested OER conditions. Conversely, d-PDF demonstrated that most effective electrocatalysts for HER and ORR maintained their stability during the experimental conditions.

**References**

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