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Reversible cuprous oxide hydroxylation in humidity studied by in-situ L3-edge X-ray absorption spectroscopy

Content

We investigated the water-induced surface chemistry of copper foil prepared in three distinct oxide states, namely, metallic, Cu(I), and Cu(II), by in-situ Cu L3-edge X-ray absorption spectroscopy (XAS). A typical dip-and-pull configuration was set up to generate the interfaces for the study. The spectra were taken from total fluorescent yield (TFY) and total electron yield (TEY). The former was acquired by a vacuum-insulated MCP detector, whereas the latter was recorded simply through the sample drain current. The TEY-XAS in this study reveals the copper chemical state only at the surface, as the metallic-copper sample body dominates TFY-XASs. In ~10 mbar of water vapor, the TEY-XAS from Cu(I) oxide shows a prominently stronger pre-edge absorption. This pre-edge boost vanishes when the water vapor is removed from the chamber or when the surface is wetted. The finding suggests a reversible Cu(I) hydroxylation in humid conditions, as will be discussed in the presentation.

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