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Synchrotron radiation studies on magnetic Fe-oxide nanowires electrodeposited into porous alumina templates

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Fe nanowires (NWs) were electrodeposited into a porous alumina template using a pulsed electrodeposition method. The Fe NWs were then thermally oxidized under different annealing conditions: times between 6 and 19 hours; heating rates in the range 0.5-5 °C/min; annealing temperatures between 500 and 650 °C and Ar or O₂ atmospheres.

The structural characterization in the soft X-ray region was not completely successful due to the complex mixture of Fe-oxide phases [1]. For that reason X-ray absorption spectroscopy (XAS) measurements at the Fe K-edge in both transmission and fluorescence modes were developed at XAFS beamline of ELETTRA synchrotron (Trieste, Italy). The higher sensitivity of XAS helped us to differentiate among the different Fe-oxide and quantify the oxide nature of the samples. This analysis allows us to conclude that six hours of annealing at 600 °C is required to obtain hematite-rich NWs. These hematite nanostructures are promising candidates for increasing the performance of photoelectrochemical cells for water splitting [2,3].

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