

## Electronic Supporting Information

### Understanding fundamental electrical and photoelectrochemical behavior of hematite photoanode

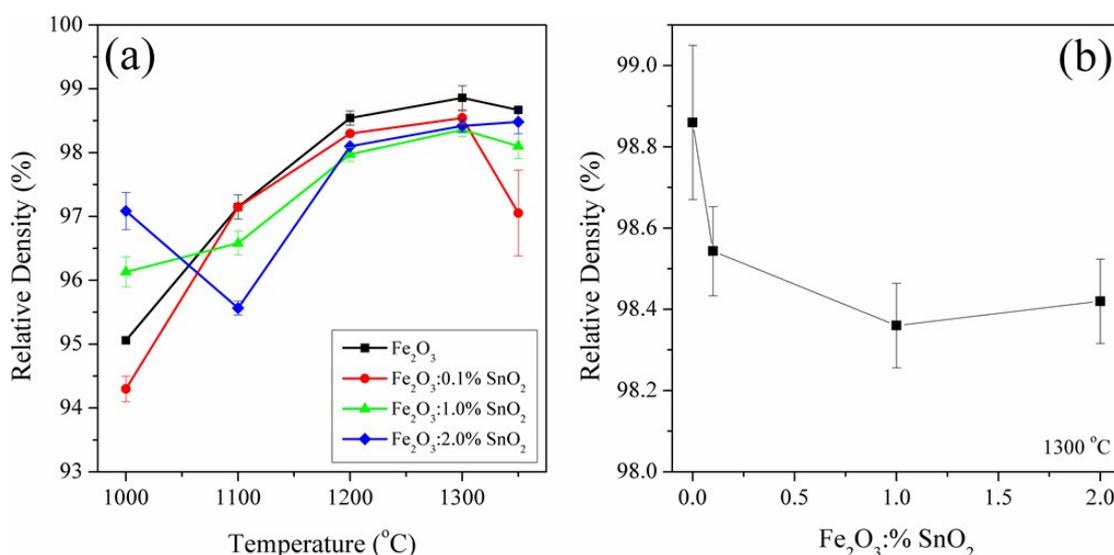
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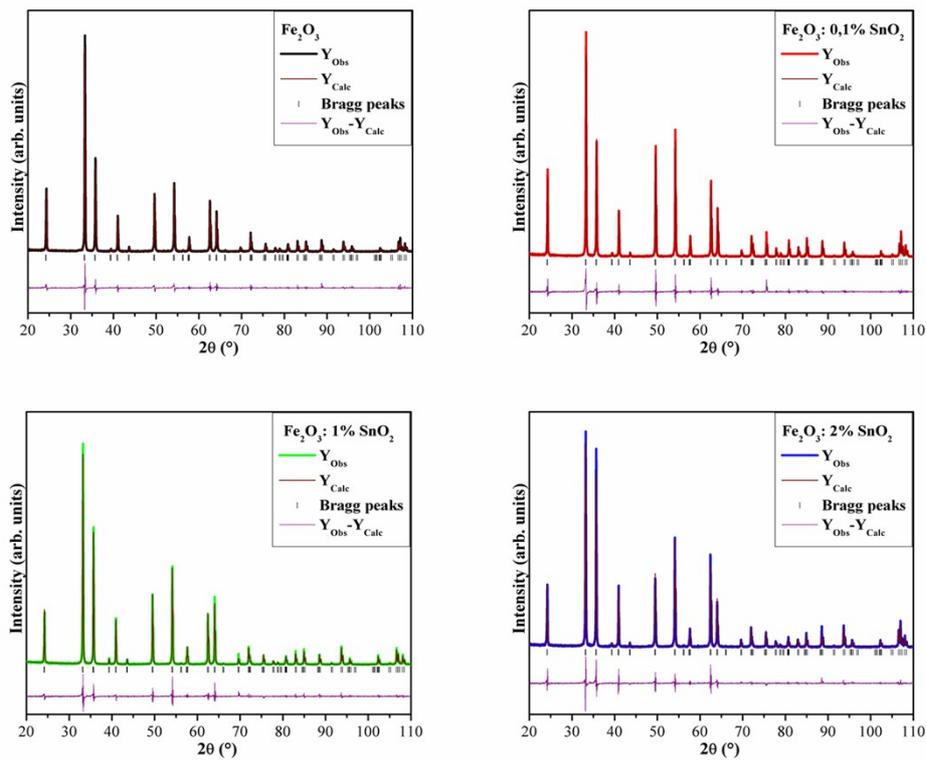
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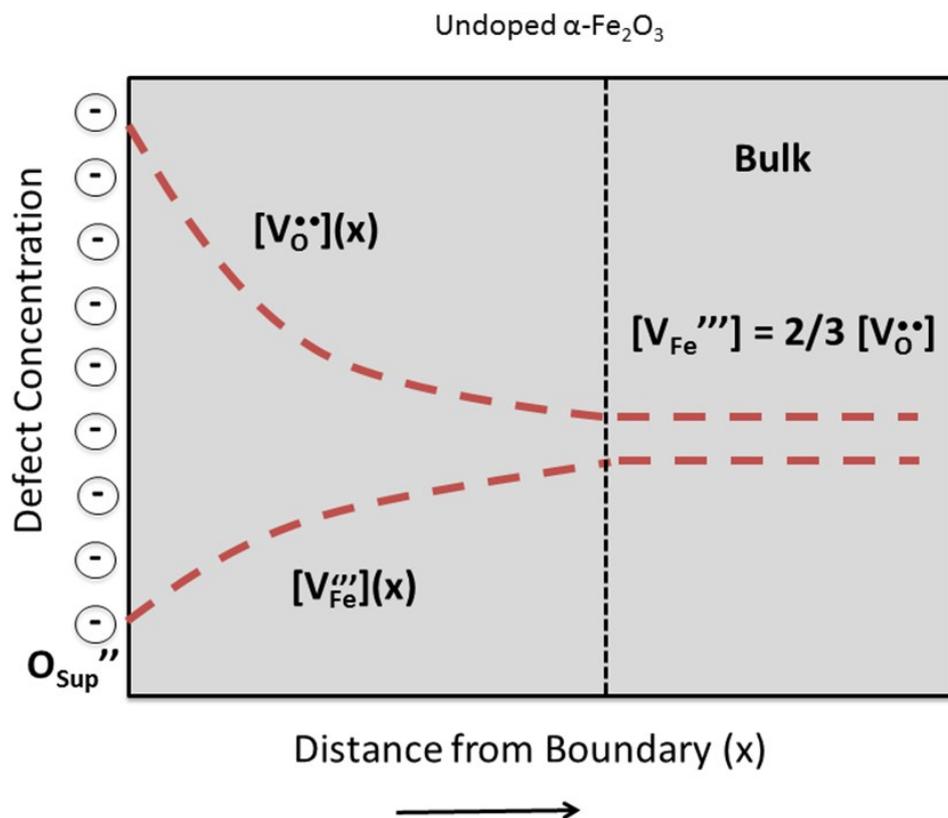
<sup>d</sup> Physics Department, Federal University of São Carlos, São Carlos, SP, Brazil.



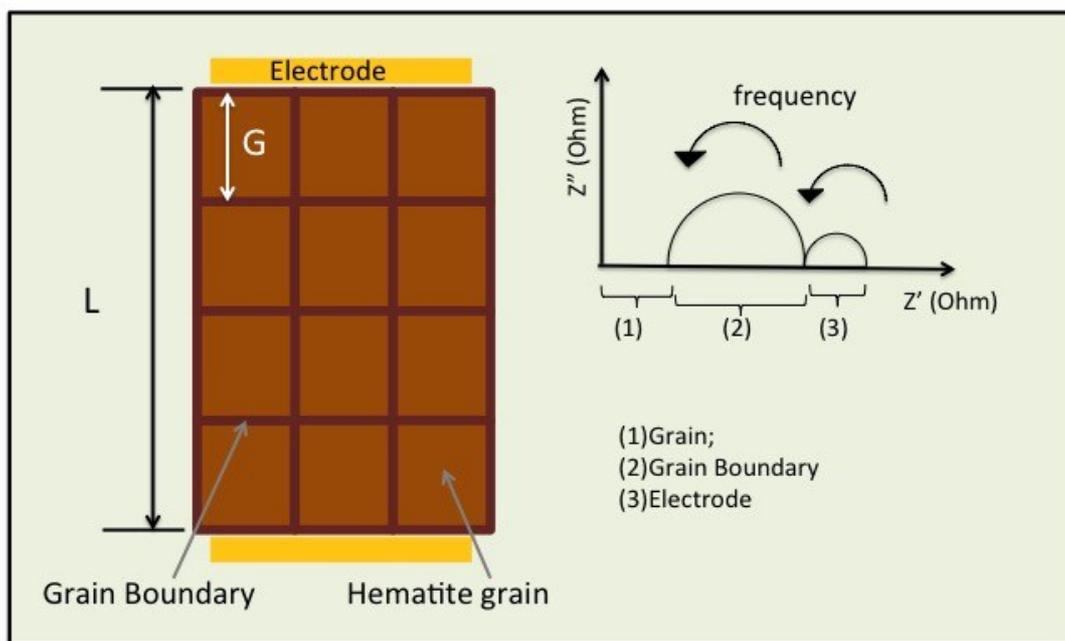
**Fig. S1.** Optimization of the sintering process: a) relative density as function of the temperature (sintering time of 6 h.) for the hematite, considering different SnO<sub>2</sub> concentration; b) relative density as function of the concentration of SnO<sub>2</sub> (sintering temperature of 1300 °C, sintering time 6h).



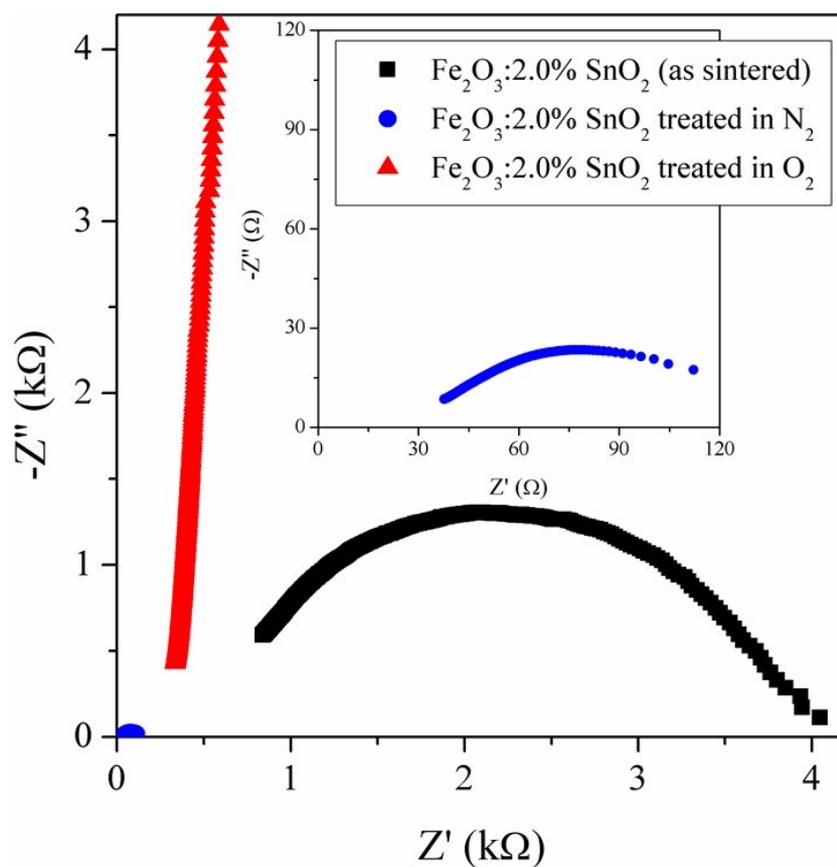
**Fig. S2.** Rietveld refinements of the hematite doped with different  $\text{SnO}_2$  concentration.



**Fig. S3.** Schematic representation of the boundary space charge and the concentration of associated charged defects in the undoped hematite.



**Fig. S4.** Schematic representation of the brick-layer model used for the SSIS analysis.



**Fig. S5.** SSIS analysis (Nyquist plot) of the samples doped with 2% wt. of  $\text{SnO}_2$  and treated at different atmospheres. The inset shows in detail the sample treated in  $\text{N}_2$  flow.

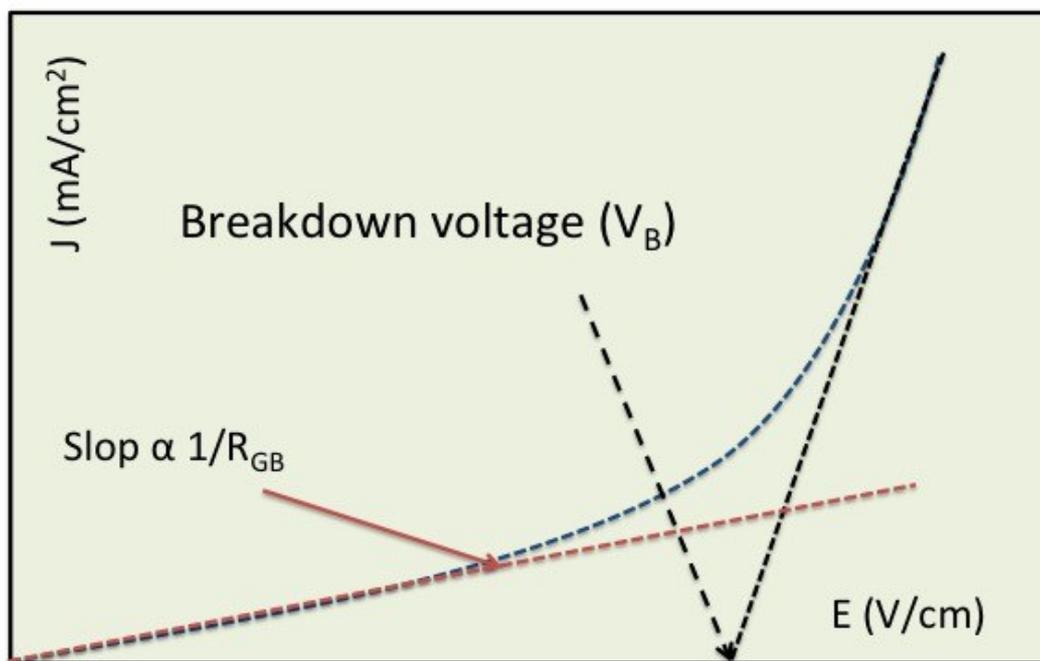


Fig. S6. Analysis of the J vs. E plot.

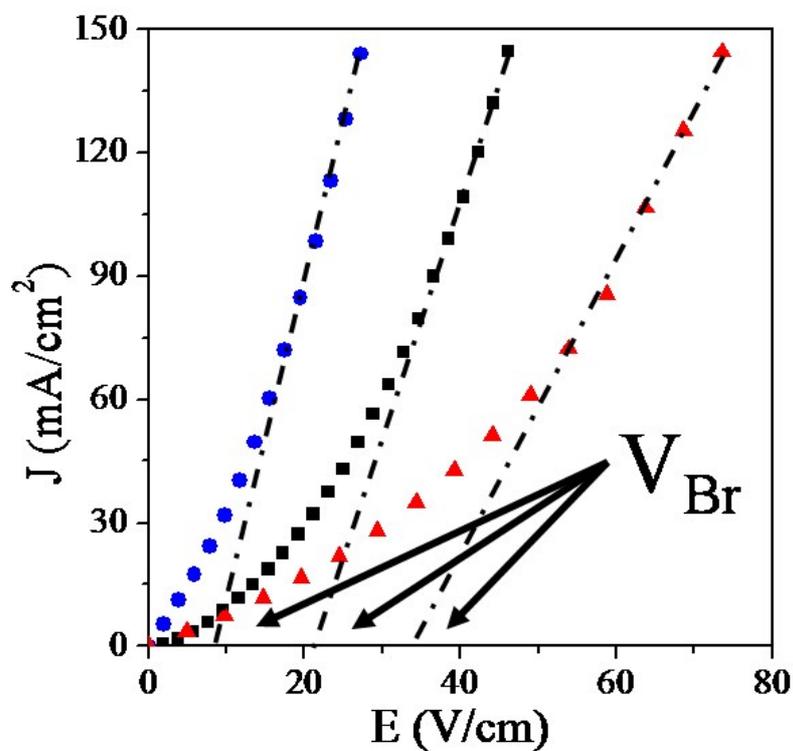


Fig. S7. Breakdown voltage ( $V_{Br}$ ) presented at J vs. E plot for the doped samples with 2% wt. of  $\text{SnO}_2$  and treated at different atmospheres: black square represents sample as sintered; blue circle represents treatment in  $\text{N}_2$  flow and red triangle represents treatment in  $\text{O}_2$  flow.