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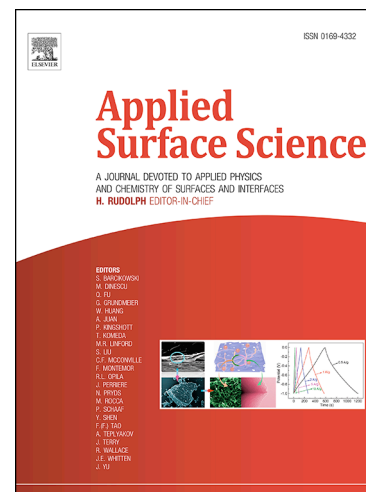
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# Molten salt synthesis of oxygen-deficient SnO<sub>2</sub> crystals with enhanced electrical conductivity

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## Abstract

Spiky polycrystalline SnO<sub>2</sub> balls assembled from pyramid-shaped SnO<sub>2</sub> nanocrystals with surface oxygen vacancies were synthesized by a simple and facile in-situ molten salt oxidation method using SnCl<sub>2</sub> as tin source and graphite as surface reductant. In this method, perfect SnO<sub>2</sub> nanocrystals are first formed on the surface of graphite particles at 500°C. By increasing the processing temperature to 700°C, the formation of surface oxygen vacancy defects was confirmed, supported by various characterization methods including Raman and XPS spectroscopy. A sharp increase in the bulk electrical conductivity of the samples was detected by exceeding the onset temperature corresponding to the formation of oxygen deficient SnO<sub>2</sub> crystals, at which the conductivity of the sample significantly outperformed that of commercial SnO<sub>2</sub> nanoparticles. The formation of oxygen vacancies on SnO<sub>2</sub> crystals is thermodynamically studied, and suggested to occur by surface carbon reduction of the crystals at sufficiently high temperatures. The enhanced electrical conductivity of oxygen deficient SnO<sub>2</sub> crystals can lead to a wider application of tin oxides in advanced electrical applications.

**Key words:** SnO<sub>2</sub> crystals; Oxygen vacancy; Molten salt; Electrical conductivity

## 1. Introduction

Tin oxide (SnO<sub>2</sub>), as a wide band gap n-type semiconductor ( $E_g=3.6$  eV at room temperature) is of

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