Experimental Section

SnO$_2$ nanorods were prepared by feeding the volatile precursor vapor into a hydrogen–oxygen co-flow diffusion flame. Figure S1a shows the experimental set-up of the aerosol flame reactor schematically, containing a precursor delivery unit, a diffusion flame reactor and a particle collection unit. A co-flow diffusion nozzle consists of two concentric stainless-steel tubes with inner diameters of 4.0, 6.0, and 6 holes of 1mm diameter uniformly distributed at a radius of 9 mm around the nozzle axis as shown in figure S1b. Precursor solution was fed to the vaporizer at the rate of 4 ml/min by a rate-controlled syringe pump (ALC-IP900) and 1.5 m$^3$/h air preheated to 250°C was used as carrier gas to transport the
vaporized precursor mixture to the central tube of the nozzle. The flow rates of air in the second ring and H₂ in the third ring were both 1 m³/h. Peak temperatures for the aerosol flame are about 2000 K as measured by platinum-rhodium thermocouple. Reaction room with adjusted length was used to control the flame height (FH(cm)), which is approximately equal to the particle resident time. All gas flow rates were controlled by calibrated rotameters. The vaporizer, the gas delivery tubes to the burner and the burner itself were kept at 250 °C to prevent condensation of precursor vapor. The products were collected on the filter with the aid of a vacuum pump and HCl was absorbed by water. The basis liquid precursor solution was composed of alcohol and tin chloride anhydrous. Dopant species were iron chloride anhydrous, lithium chloride, zinc chloride. The influence of Flame resident times (15, 30 and 50 cm) and dopant concentrations on the SnO₂ structures were systematically studied. Dopant concentrations ranged between 0 and 2.5 at.% with respect to the Sn metal. The Sn metal concentration for each precursor solution was 0.85 mol/L.

Figure S1. (a) Schematic experimental set-up and (b) co-flow diffusion nozzle for flame synthesis of SnO₂ nanorods.

Characterizations. Samples were characterized using X-ray diffraction (XRD, Rigaku D/max 2550VB/PC with CuK radiation), transmission electron micrograph (JEM-2010, operated at 200 KV), high-resolution transmission electron microscopy (HRTEM, JEM-2100). The optical properties were investigated by photoluminescence (PL) spectroscopy (Jobin Fluorolog-3-p, excited with a Xe lamp).
Photoluminescence (PL) spectra for 0.0, 1.0 and 2.0 at.% Fe doped SnO$_2$.

In order to investigate the influence of Fe content on PL property of SnO$_2$, we tested the PL spectra of 0.0, 1.0 and 2.0 at.% Fe doped SnO$_2$ under the same condition, and the results are shown in figure S2. Broad, strong orange-emission peaks locating around 620 nm were observed in all three samples. Furthermore, the relative intensity of this peak increased with increasing of Fe content, which can be attributed to the more oxygen vacancies formed with increasing Fe content.

![Figure S2. Room temperature photoluminescence spectra of 0.0, 1.0 and 2.0 at.% Fe doped SnO$_2$.](image)

**Substitution equation.** In order to explain possible changes in the Fe doped SnO$_2$, the potential replacement reactions in the SnO$_2$ lattice are discussed as follows. With the addition of Fe$_2$O$_3$ the possible substitution equation, where the Kröger–Vink standard notation is used, are:

\[
\text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe}^{3+}_\text{Sn} + V_\text{O}^{\prime\prime} + 3\text{O}_\text{O}
\]

So modification of the SnO$_2$ by introduction Fe leads to the substitution of Sn$^{4+}$ ions by Fe$^{3+}$ and generates oxygen vacancies, resulting in the enhanced photoluminescence.