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Deciphering interfacial properties and intermediaries via probing lattice deformations: Growth solution chemistry for mixed/pure phase metal oxide/perovskites

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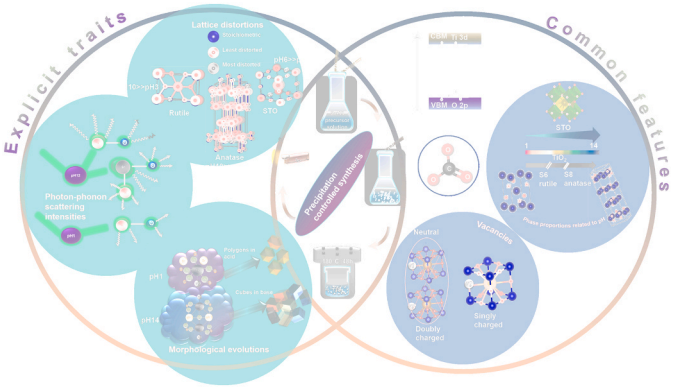
GRAPHICAL ABSTRACT



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ABSTRACT

pH of the growth solution of nanomaterials has been employed as a controlling agent in the morphology and synthesis of various metal oxides. The key points in the reconciliation with the thus formed nanostructures inevitably revolve around the impact of H^+ and OH^- ions on the oxide phases formed during various stages of the phase evolution. Here, a careful elucidation of acidic and alkaline conditions that influence the evolution of the perovskite of Strontium titanate (STO) has been done taking care to avoid the influence of other reagents by avoiding their use altogether. Multiple incremental steps of the growth solution's pH were the only variable, allowing a direct correlation of the alkalinity with the several interesting materializations of the perovskite composition. The fundamental aspects on the development of the different phases such as the lattice strains due to expansions and contractions of the lattice, integration of shallow level defects as a result of the growth conditions, visualizations of the interfaces between multiple phases which were always present when the growth conditions were not completely alkaline have been revealed through different structural and morphological characterizations. The catalytic property of the samples prepared at different pH levels investigated using UV light exhibited markedly different photocatalytic activity toward Rhodamine B (RhB). We propose that the tuned phase compositions and morphologies are the reason for the observed variations. The different compositions of

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