

Structural Properties of $\text{Pr}_{1-x}\text{Sr}_x\text{FeO}_3$ materials For Solid Oxide Fuel Cells

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Abstract- $\text{Pr}_{1-x}\text{Sr}_x\text{FeO}_3$ ($0 \leq x \leq 0.6$) is a cathode material, which are set up by sol-gel method. In the example the powders are framed in the scope of 600°C - 700°C . The Sol-Gel is unit for the examples; these described as single stage GdFeO_3 kind of perovskite structure utilizing powder XRD. For the example the Orthorhombic distortion diminishes with expanding x esteem. The decrease of pseudo cubic cross section steady is down to earth with Sr content. The crystallite measure for undoped test is in the range 25nm to 30nm and 55nm to 60nm as-incorporated and burn powders individually. The weight reduction is 3% to 26% and in augmentation of x esteem the weight reduction is diminished for as-synthesized powders.

Keywords- Sol-Gel route, X-ray Diffraction, Thermogravimetry, SOFC. etc.

I. INTRODUCTION

The solid oxide fuel cells (SOFC) plays an important role because of its high energy conversion efficiency, environmental compatibility, furthermore, capacity to utilize hydrocarbon energizes straightforwardly without outer changing. Most by far of impetuses utilized in present day concoction industry depend on blended metal oxides including perovskite oxides ABO_3 , where A is a rare-earth element, B is 3d transition metal remain prominent. Likewise, perovskite oxides crystals can have wide applications in trend setting innovations, for example, strong oxide power modules, impetuses and substance sensors, attractive materials, anode materials, etc [1, 2].

Ternary oxides $\text{A}_{1-x}\text{A}'_x\text{BO}_3$ with perovskite structure shape a substantial class of mixes, which for the most part show particular physical properties and are broadly utilized practically speaking. Their structure varies from that of perovskites of paired oxides ABO_3 by the nearness of cations of two sorts (A_n and A'_n) in octahedral destinations of the A sub lattice (for the most part, with various degrees of requesting of their shared course of action). In the meantime, ternary and twofold oxides of these classes share much for all intents and purpose in the kind of auxiliary stage advances, the character of grid twisting in low-temperature stages and some different parameters. At high temperatures, precious stones of the two classes have an orthorhombic structure of perovskite with course of action of A_n and A'_n cations in the cross section [3].

The dominant part of current cathodes depends on the LSMO and LSCO or LSFO [4]. In the two ferrites and

cobaltite's, the oxide particle dispersion is a few requests of size higher than in manganites. Strontium doped lanthanum manganite perovskite oxides (LSMO) have for a few years been promising cathode materials and actually, have been utilized in the development of current SOFC gadgets. This, together with other potential utilizations of this sort of perovskite oxides, has prompted a broad work dependent on these frameworks and LSMO are generally poor oxide conductors [5]. Structure and attraction of $\text{Pr}_{1-x}\text{Sr}_x\text{FeO}_3$ were accounted for by scientists [6, 7]. Anyway there is no methodical report about praseodymium ferrite as cathode material for SOFCs. In this work, precious stone structure and Thermo gravimetric examination of $\text{Pr}_{1-x}\text{Sr}_x\text{FeO}_3$ ($x=0-0.6$) (PSFO) perovskite oxide cathodes were considered as a novel cathode material for SOFCs [8]

II. EXPERIMENTAL PROCEDURE

The PSFO powders were set up by sol-gel method [9]. High virtue materials were utilized as beginning materials. Point by point readiness system clarified in the past papers [10, 11]. The X-beam diffraction designs were recorded utilizing Philips Expert PRO, PAN Alytical, Model No.PW 3040 X-beam diffractometer with a checking rate of 2 degree/min utilizing Cu-K_α radiation between 20 to 80 degrees. The normal crystallite measure was evaluated from the line expanding in the X-beam powder diffraction designs utilizing the Scherrer condition. Mettler Toledo instrument 851e model was utilized for TG analyze. The information was consumed from space temperature to 1000°C . The rate of warming is $10^\circ\text{C}/\text{min}$. further more, precision of the instrument is $\pm 0.25^\circ\text{C}$.

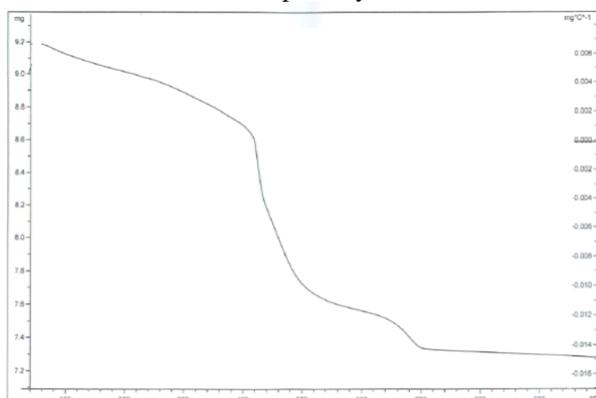
III. RESULTS & DISCUSSION

All the recorded peaks are filed utilizing d separating and 2θ as contribution based on orthorhombic structure. The cross section parameters and volume of the unit cell are assessed utilizing xlat programming and are given in Table 1. With the expansion of strontium fixation the volume demonstrates an inclination to diminish for PSFO [11]. As indicated by Pauling's second standard, the development of the tetravalent Fe particles is relied upon to reinforce the Fe-O bonds in FeO₆ octahedral [12]. Therefore, the span of FeO₆ octahedral and the volume of the perovskite unit cell diminish. Orthorhombic misshapening (D) is substantial on account of the undoped compound, caused fundamentally by the high estimation of the cross section parameters [13]. The expansion of the Sr dopant fixation results in the lessening of D, when the grid parameters have close qualities.

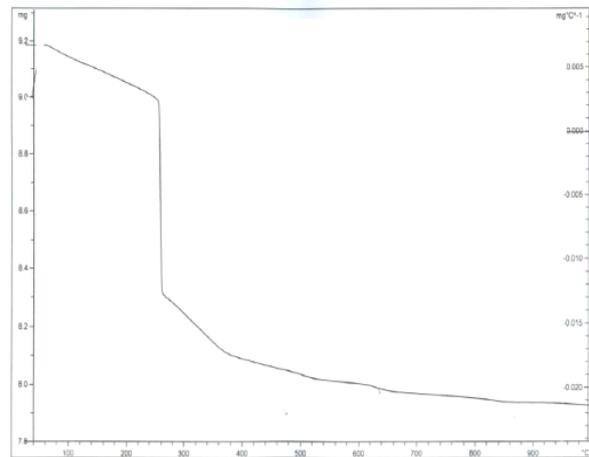
Table 1 Crystallographic data of Pr_{1-x}Sr_xFeO₃ ($0 \leq x \leq 0.6$)

x	Crystal Structure	Volume (Å ³)	a, b, c/√2 Relation	D
0	Orthorhombic	253.51	$c \sqrt{2} \approx a \approx b$	0.531
0.2	Orthorhombic	251.59	$c \sqrt{2} \approx a \approx b$	0.404
0.4	Orthorhombic	245.27	$c \sqrt{2} \approx a \approx b$	0.239
0.6	Orthorhombic	244.17	$c \sqrt{2} \approx a \approx b$	0.175

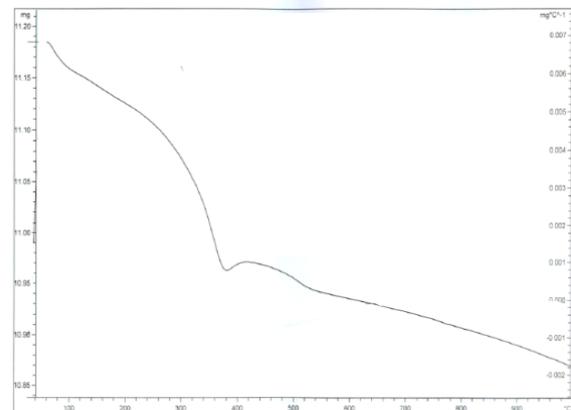
Thermo gravimetric investigation (TGA) on PSFO powders with $x = 0$ to 0.6 were performed in air. The weight misfortunes saw after warming in air are plotted against temperature in Fig. 1. The temperature at which weight reduction ends up critical declines and the size of oxygen misfortune changes, with increasing Sr content [14, 15]. The weight reduction from RT to 1000°C for PFO, PSFO₂, PSFO₄ and PSFO₆ is 26.0%, 16.5%, 3.2% and 3.1% separately.



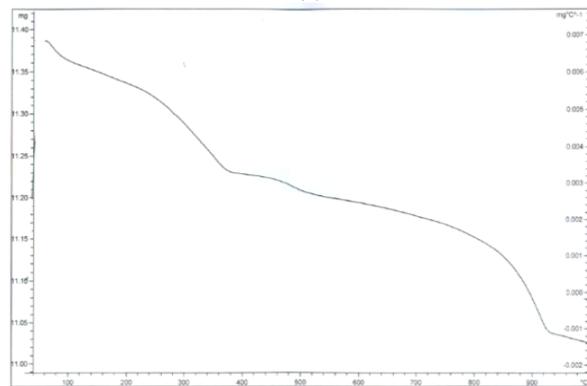
(a)



(b)



(c)



(d)

Fig.1 TGA of Pr_{1-x}Sr_xFeO₃ (a) $x=0$, (b) $x=0.2$, (c) $x=0.4$ and (d) $x=0.6$.

IV. CONCLUSIONS

Every one of the examples of PSFO was framed in single stage. The X-beam diffraction results demonstrated that PSFO display the orthorhombic structure. The unit cell volume diminished with expanding strontium content because of littler size of the Fe⁴⁺ as contrasted and that of Fe³⁺ in B-site. The

weight reduction is 3 to 25% and weight reduction is diminished with expanding Sr dopant for as-incorporated examples.

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