Supporting Information for:

High temperature redox chemistry of

$Pr_{0.5}Sr_{1.5}Cr_{0.5}Mn_{0.5}O_{4-\delta}$ investigated *in situ* by neutron

diffraction and X-ray absorption spectroscopy under

reducing and oxidizing gas flows

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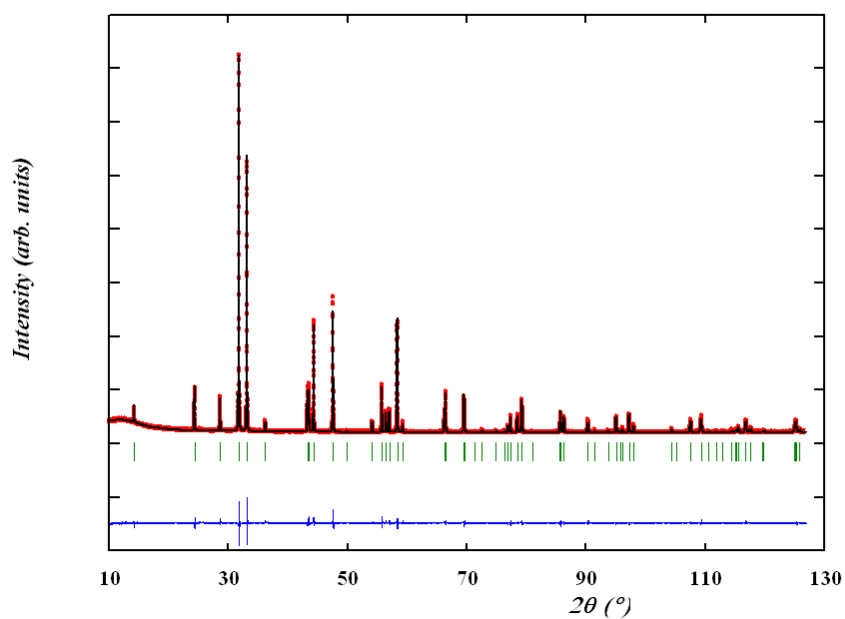
Battle[5*]

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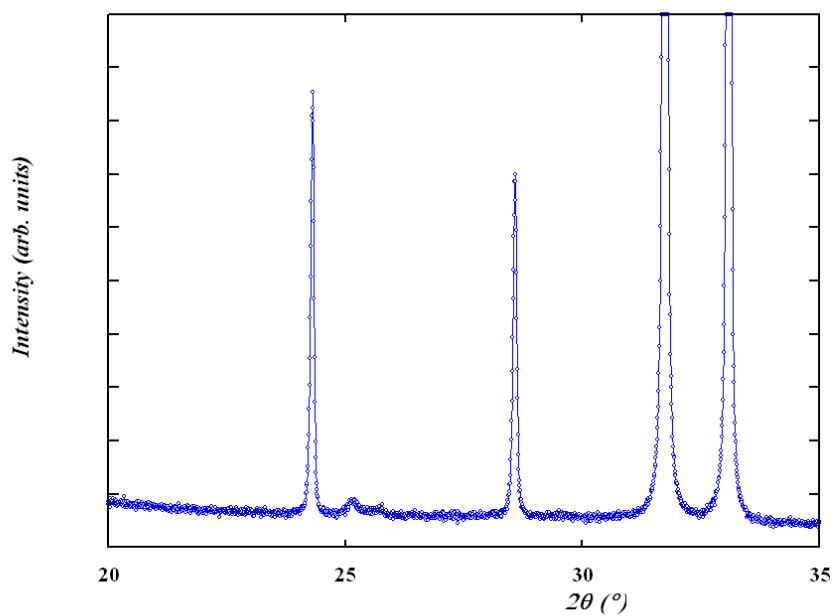[3]Institut Laue-Langevin, 6, rue Jules Horowitz 38042 Grenoble Cedex, France
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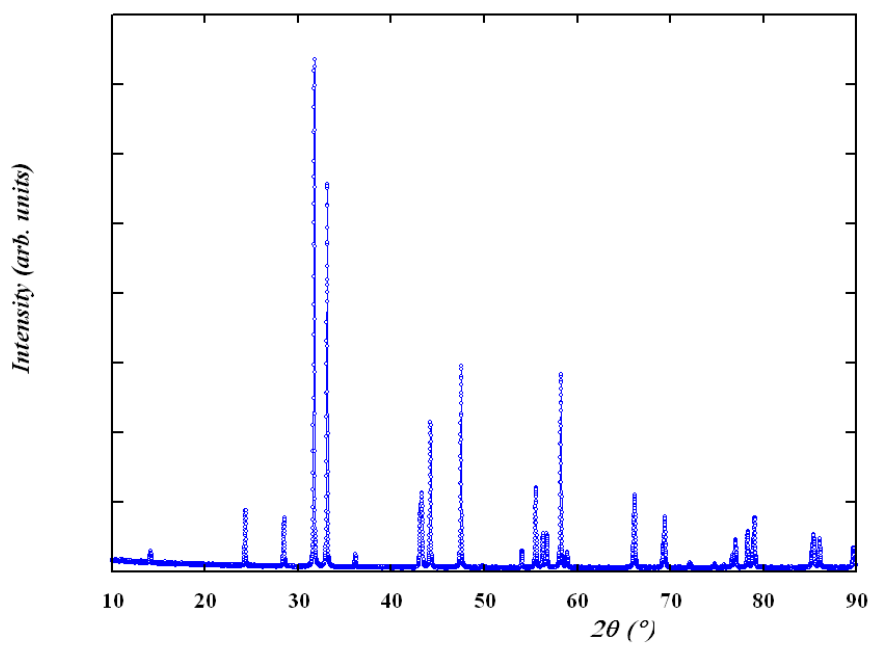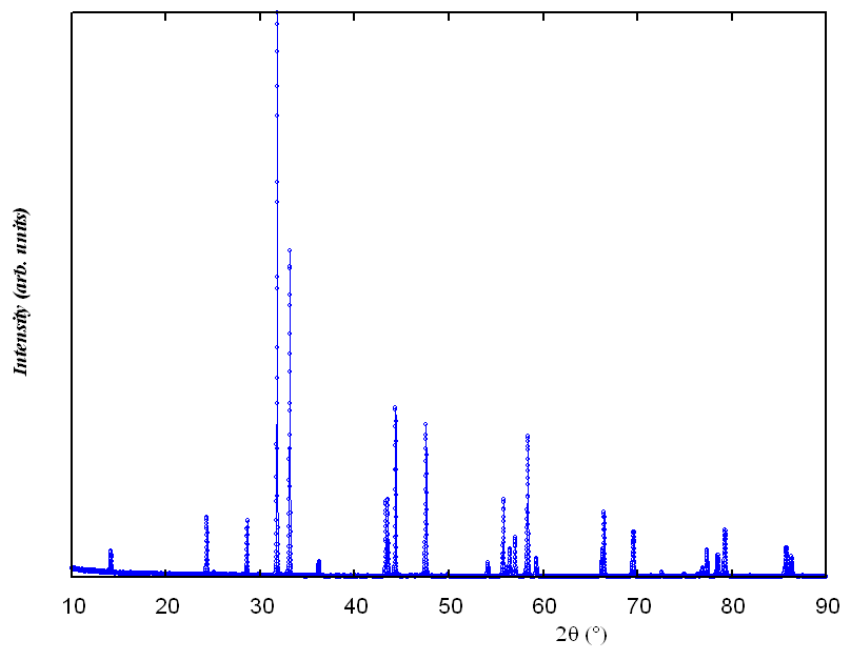
(a)

(b)

Fig. S1 (a) Rietveld-fitted X-ray diffraction of as-prepared $Pr_{0.5}Sr_{1.5}Cr_{0.5}Mn_{0.5}O_4$ (sample I) and (b) zoom of the low angle region showing the presence of $SrCO_3$ secondary phase with its maximum intensity at $2\theta \approx 25°$.

(a)

(b)

Fig. S2 X-ray powder diffraction pattern of (a) sample II, (b) sample III.

Fig. S3 X-ray powder diffraction pattern of sample IV.

Table S1: Results on the principal component analysis of Mn K-edge spectra collected on heating $Pr_{0.5}Sr_{1.5}Cr_{0.5}Mn_{0.5}O_{4-\delta}$ under a flow of 5% H_2-He.

Component	eigenvalue	IND	REV Significance Level	DRMAD
1	5.53515e+04	1.22657e-06	0.0	0
2	6.38318e-01	9.88310e-07	0.002	1
3	6.52355e-02	9.92480e-07	13.94	1
4	3.12483e-02	1.01480e-06	29.95	1
5	2.68563e-02	1.04035e-06	33.21	1
6	2.49004e-02	1.06800e-06	34.70	1
7	2.43372e-02	1.09702e-06	34.92	1
8	2.24722e-02	1.12848e-06	36.53	1
9	2.15070e-02	1.16196e-06	37.31	1
10	2.12400e-02	1.19707e-06	37.34	1

The table lists the first ten eigenvalues and the corresponding indicator functions. Algorithms to define the significance level of the REV function, together with the IND and DRMAD functions are defined in reference [38] and references therein.