Growth and characterization of $Dy_{(1-x)}Sm_{(x)}MnO_3$ single crystals by optical floating zone technique

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The rare-earth (*RE*) manganites with general formula *RE*MnO_3 (RE^{3+} = La – Yb, Y) display wide ranging functional properties with potential for technological applications. Depending on growth ambience and the size of RE^{3+} ions, these manganites crystallize either in orthorhombic P*nma* space group symmetry or hexagonal P6_3cm space group symmetry. In the present work, we understand the role of Sm^{3+} substitution on $DyMnO_3$ in the air atmosphere. $Dy_{(1-x)}Sm_{(x)}MnO_3$ powders were synthesized by solid-state reaction and single crystals were grown using optical floating zone technique for the composition range $0 \leq x \leq 0.75$. Energy dispersive x-ray spectroscopy (EDS) confirms the nominal composition for all the grown crystals of $Dy_{(1-x)}Sm_{(x)}MnO_3$. Laue diffraction taken on the grown crystals confirms the orthorhombic (o) symmetry. Our LeBail refinements using synchrotron X-ray powder diffraction data on powders obtained after crushing the crystals also confirm the orthorhombic phase with *Pnma* space group for the composition range $0 \leq x \leq 0.75$ (see Figure 1). The unit cell volume and lattice parameters are shown to increase with increasing Sm^{3+} substitution at the Dy^{3+} site in $DyMnO_3$. This can be attributed to the fact that the ionic radius of Sm^{3+} is larger than that of Dy^{3+} and hence substitution of Dy^{3+} by Sm^{3+} would lead to lattice expansion. The physical and magnetic properties of these single crystals will be reported.

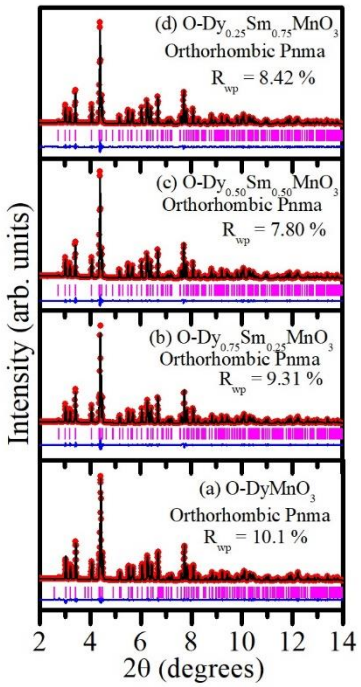

Figure 1: Observed (red filled circle), calculated (black continuous line) and difference profiles (blue continuous line) obtained after LeBail refinements of the synchrotron X-ray diffraction data of $Dy_{(1-x)}Sm_{(x)}MnO_3$. Vertical tick marks the Bragg peak positions.