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Crystal structure analysis of non-stoichiometric cobalt ferrite**Aminul Islam**

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Non-Stoichiometric chromium substituted Cobalt ferrite with the composition of $\text{Co}_{1-x}\text{Cr}_x\text{Fe}_2\text{O}_4$ ($x=0.125, 0.25, 0.375$, and 0.5) have been synthesized by solid-state reaction technique via ball-milling taking the sintering temperature at 1200°C . The X-ray diffraction (XRD) analysis of the prepared samples confirms the formation of cubic spinel structure with space group of $\text{Fd-}3\text{m}$ showing the secondary phase of $\alpha\text{-Fe}_2\text{O}_3$. The cation distribution for the synthesized samples has been estimated by the Rietveld analysis. The refinement result shows the occupancy of Cr in both the tetrahedral site (A-site) and octahedral site (B-site) with an exact ratio. The experimental lattice parameter shows decreasing value with an increase of Cr content which follows the theoretical lattice parameter. At higher concentrated Cr^{3+} substituted with Co^{2+} and at higher concentrated Fe^{3+} lowering the tolerance factor, and both the ionic packing coefficient that expanding the values of vacancy parameter. This behaviour indicates the lowering of cation-anion vacancies due to the displacement of Fe^{3+} from the standard cubic structure and shows $\alpha\text{-Fe}_2\text{O}_3$ in the XRD pattern. The crystallite size calculated from XRD data is found to be decreasing value with an increase of Cr content. The functional group was measured using FTIR in the range of wave number $1000\text{--}400\text{ cm}^{-1}$ which confirms spinel structure. SEM is used for

determining grain size and found agglomerated with different sizes. The force constant calculated from FTIR data that have been found to be decreasing value with increase of Cr concentration which results in the decreasing value of elastic modulus, Debye temperature, and thermal conductivity. The non-stoichiometry of the studied samples may modify the exchange interaction which may modify the Curie temperature.

Biography

Aminul Islam is the young scientist of Material Science Laboratory-1. He completed his B.Sc. in Physics (Hons') and M.Sc. in physics from National University, Bangladesh. Also, he has been awarded his second M.Sc. degree (Physics) from Bangladesh University of Engineering and Technology (BUET), Bangladesh. He has enrolled as a Ph.D. student in the Dept. of Physics, BUET and completed his theoretical course and completed his Ph.D.-related research work, and waiting for the final evaluation of his Ph.D. degree. In addition, he has completed more than three projects work and now working on another 3 projects work. He is now working on both theoretical (DFT) and experimental research. 24 journal papers have been published on his in well-known journals. Mr. Aminul has joined more than 100 international conferences, workshops, seminars, and webinars, IUCr-2017, India, AsCA-2019, Singapore, and IUCr-2021 (Virtual) are a few of them. He has been awarded as a young scientist from AsCA -2019 conference.

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