Structural analysis of nanocrystalline spinel synthesized by quasicrystalline precursor

Harshit Agarwal¹, T. P. Yadav¹, O. N. Srivastava¹, M. A. Shaz¹

¹Department Of Physics, Institute Of Science, Banaras Hindu University, Varanasi, Varanasi, India

E-mail: harshit.physics@gmail.com

The cations Co²⁺/Ni²⁺ and Al³⁺ distribution in nanocrystalline (Co,Ni)Al₂O₄ spinel have been investigated using X-ray and transmission electron microscopy. The novel nanocrystalline (Co,Ni)Al₂O₄ spinel has been synthesized by mechanically milling of Al₇₀Co₁₅Ni₁₅ decagonal quasicrystalline precursor with further annealing at 873 K under a controlled oxygen atmosphere for 20 hours. The x-ray diffraction data has been refined by the Rietveld method using JANA2006 and subsequently, the corresponding structure has been constructed using software Diamond 4.1. The phase structure has also been confirmed by analysis of transmission electron microscopy. Selected area diffraction (SAED) pattern obtained by TEM has been linearized by diffraction ring profiler software, which is analogous to XRD pattern of (Co,Ni)Al₂O₄ confirms the d-values and corresponding plane. This is new software where data extracted from SAED is used for probable refinement. These analyses indicate that the cations Co²⁺ and Ni²⁺ distributed in the tetrahedral coordinated sites are the dominant species in the normal spinel phase.


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