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Studies of the Incorporation of the Co and Mn into the ZnO Wurtzite Matrix: The Development of true Dilute Magnetic Oxides

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The feasibility to prepare single-phase large band-gap dilute magnetic oxides (semiconductors) has been challenging the fully understanding of the magnetic properties of such materials and obstructing the developing of practical spintronic devices. Besides the problem related to the transitional metal incorporation into the oxide matrix, there is a growing consensus that punctual defects plays an important role to achieve the desired room temperature ferromagnetic properties [1]. The transitional metal doping revealed not to be a sufficient condition, a specific proportion of specific kind of defect have to be also introduced in the oxide matrix. The nature of the specific defects are now a matter of debate. In this work, we studied the incorporation of Co and Mn into the ZnO matrix via the solid-state reaction method. We used high purity powders of ZnO, Co3O4 (cobalt II, III oxide), CoO (cobalt II oxide) and Metalic-Co as precursors in the case of the Co doping, and MnO2 (manganese IV oxide), MnO (manganese II oxide) and Metalic-Mn for the Mn doping. We evaluated the incorporation under the scope of the Hume-Rothery theory of the solid solutions [2]. The samples were analyzed trough X-ray diffraction, Raman scattering spectroscopy and optical microscopy.

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Reference:

[1] SHARMA, V. K.; VARMA, G. D. Journal of Applied Physics, v. 102, p. 056105-1-056105-3, 2007.

[2] CHACKELFORD, J. F. Ciência dos Materiais. 6. ed. São Paulo: Pearson Prentice Hall, 2008.

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Poster

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