

# Second-Order Phase Transitions in Magnetic Crystals

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The Landau-Lifschitz-Lubarski theory of the second-order phase transitions for non magnetic crystals of ordinary space groups and their unitary irreducible representations has been reformulated for magnetic crystals and for anti-unitary groups of irreducible corepresentations. Several magnetic crystals of structure A-15  $O_h3$  experience second order phase transitions. Also the ZnO doped by Mg, Mn, Co and others becomes magnetic and therefore all the physical states of this crystals suppose to be classified according to irreducible corepresentations. Here we have determined possible magnetic and non-magnetic crystals structures of ZnO:Mg, ZnO:Mn, Zn:Co, as well as alloys structure of  $Vi_3Si$  (A-15) after second order phase transitions. Our predicted symmetries of the vibrational modes which may cause transitions from the initial space group to the subgroups are in accordance with the experimental data obtained by inelastic powder neutron, Raman, and other spectroscopies. To our best knowledge the group-subgroup criterion on magnetic corepresentations have been performed for the first time.