The Symmetry of Ordered Cubic γ-Fe_2O_3 Investigated by TEM

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Dedicated to Professor Wolfgang Jeitschko on the occasion of his 70th birthday

Well-crystallized particles of cubic and tetragonal γ-Fe_2O_3 embedded in a Pd matrix were produced besides other oxides by internal oxidation of a Pd-Fe alloy in air. Particles of tetragonal γ-Fe_2O_3 consist of orientation domains with the *c* axes normal to each other. Particles of the ordered cubic γ-Fe_2O_3 appear single crystalline in bright field and in dark field images with reflections of the basic spinel structure. In dark field images enantiomorphous domains were observed using reflections of the ordered phase. From the analysis of electron diffraction patterns in the principal zone axes the description of ordered cubic γ-Fe_2O_3 in the enantiomorphous space groups $P4_132/P4_332$ follows without further presumptions. In the sequence from space group $Fd\bar{3}m$ of disordered cubic γ-Fe_2O_3 *via* $P4_132/P4_332$ of the ordered cubic phase to the pair $P4_12_12/P4_32_12$ of tetragonal γ-Fe_2O_3 a continuous group-subgroup relation can be derived. This relation shows that ordered cubic γ-Fe_2O_3 is an intermediate phase upon ordering of vacant octahedral sites towards tetragonal γ-Fe_2O_3.

Key words: γ-Fe_2O_3, Symmetry, Electron Diffraction, Enantiomorphism, Internal Oxidation, Domain Contrast