

[o.m13.p15] High Temperature Phase Transformation of $Y_4Al_2O_9$. M. Shimada, H. Yamane and B.A. Hunter^(*). *Tohoku University, Sendai, 980-8577, Japan, (*)ANSTO, Menai, New South Wales 2234, Australia.*

Keywords: phase transformation, rare earth aluminate, neutron diffraction.

High-temperature phase transformation in ceramic materials have been investigated for possible alternative transformation tougheners to tetragonal zirconia.

Studies by differential scanning calorimetry and dilatometry revealed reversible phase transformation in $Y_4Al_2O_9$ and the phase transformation temperature was 1377°. A high temperature study observed discontinuities and anisotropic change of lattice parameters at 1400° using the high temperature X-ray powder diffraction. However, in order to clarify the mechanism of the phase transformation it is necessary to determine the crystal structure of the high-temperature phase.

In the present study, we examine the crystallographic relationship between the structure of the high- and low-temperature phases of $Y_4Al_2O_9$ as determined by high-temperature neutron powder diffraction.

The anisotropic thermal expansion and anisotropy of lattice volume change at 1400° were confirmed by high-temperature neutron diffraction.

The crystal structure of high-temperature phase was determined to be monoclinic with space group $P2_1/c$. The phase transition was diffusionless. At the transition, the atoms in the unit cell move cooperatively on the slip planes of oxygen atoms parallel to (010) plane along a axis.

[o.m13.p16] The study of ordered phases in $Ti_{1-u}V_uC_{0.6}$. M.Yu. Tashmetov^{1.}, V.T. Em^{1.}, C.H. Lee^{2.}, H.S. Shim^{2.}. *1.Institute of Nuclear Physics of Academy of Sciences of Uzbekistan, 702132 Tashkent Ulugbek, Uzbekistan., 2. Korea Atomic Energy Research Institute P.O.Box 105, Yusong, Taejon, Korea 305-600.*

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The crystal structure of nonstoichiometric carbides $Ti_{1-u}V_uC_{0.6}$ have been studied using X-ray and neutron diffraction method. The samples of carbides were prepared by sintering of titanium, vanadium and carbon. It was shown that in disordered state the studied compounds possess the NaCl type crystal structure: Ti and V atoms randomly occupy positions of face centered cubic (fcc) lattice, while C atoms randomly occupy octahedral voids of metal matrix. After annealing at 870K the ordering of carbon atoms was observed while metal matrix remained disordered: in space group $Fd\bar{3}m$ the Ti and V atoms randomly occupy positions 32(e), the carbon atoms preferentially occupy octahedral positions 16(c), the rest of carbon atoms occupy octahedral positions 16(d). After annealing at 1000K of $Ti_{1-u}V_uC_{0.6}$ the splitting of some structure peaks on X-ray neutron diffraction patterns and the broadening of the same peaks on neutron diffraction patterns were observed. The ordered structure with trigonal unit cell satisfy the experimental data: in space group $R\bar{3}m$ (or $P\bar{3}_121$) the Ti and V atoms occupy positions 6(c), the carbon atoms preferentially occupy positions 3(b) and the rest of carbon atoms occupy octahedral positions 3(a). It is impossible to establish from powder neutron diffraction and X-ray patterns which space group ($R\bar{3}m$ or $P\bar{3}_121$) the ordered structure has, because the positions and intensities of the reflections are identical in both cases. Displacement of metal atoms from vacancies towards carbon atoms was observed in both cubic (sp.gr. $Fd\bar{3}m$) and trigonal (sp.gr. $R\bar{3}m$ or $P\bar{3}_121$) ordered phases.