Crystal Structure Change of Thermistor of Mn-Co-Ni Oxides in Firing Process

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This investigation was carried out to study the change in X-ray diffraction patterns observed in Mn-Co-Ni oxides heat-treated at high temperatures. The samples were prepared by firing the oxides of Mn, Co and Ni with molar ratio of 3.0 : 1.9 : 1.1 between 1000° and 1400°C. In the X-ray diffraction study, the change of diffraction patterns, which seemed to be due to same crystal structure change, was observed in the samples fired above 1140°-1160°C. To examine these crystal structure changes, EPMA study was made on the sample heat-treated at 1200°C. The distributions of Mn, Co and Ni were heterogeneous and the two phases, Mn-rich and Ni-rich, were observed. The quantitative analyses of Mn, Co and Ni contents were made by EPMA on these two phases. The samples with the same compositions as those of the analytical values were newly prepared by firing at 1200°C. X-ray diffraction study on these newly prepared samples proved that the Ni-rich phase had a rock salt structure and that the Mn-rich phase was estimated to have a spinel structure of composition (Co, Mn)[Mn, Co]$_2$O$_4$ in which some cations were substituted by Ni. These results proposed that the change in X-ray diffraction patterns was attributed to the phase separation of cubic spinel into tetragonal spinel (Mn-rich) and rock salt (Ni-rich) phases.

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Joining of Pressureless-Sintered SiC to Stainless Steel Using Ag-Cu Alloy and Insert-Metals

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Brazing of pressureless-sintered SiC to stainless steel using Ag-28wt% Cu alloy was studied. In SiC plate joined to stainless steel rod (6mm in diameter) using an Ag-Cu alloy powder containing 1.5wt% Ti, the bond strength increased with decreasing brazing temperature and holding time. When the increased size of stainless steel plate (10×10×4mm), joining was unsuccessful by the method mentioned above and even with Ti insert-metal. However, simultaneous use of Ti and Mo as insert-metal gave a good bonding in the order SiC/Ti/Mo/stainless steel, because of relaxation of residual stress due to thermal expansion mismatch. The shear strength was 30-50 MPa. A thin layer, probably Ti_3SiC_2, was observed at the interface between SiC and brazing filler immediately after melting. But with increasing both temperature and time, $Ti_5Si_3(C)$ and TiC_x were formed if Ti was continuously provided from the brazing filler. Since the interface of Ti_3SiC_2 and eihter $Ti_5Si_3(C)$ or TiC_x seemed to be brittle, the formation of $Ti_5Si_3(C)$ and TiC_x decreased the bond strength. At lower temperature and short time, a high bond strength is expected when Ti was inserted in contact with SiC.

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Solubility of MgO in Single-Crystal Al_2O_3

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A new diffusion-couple method was developed to determine the solubility of MgO in Al_2O_3. The solubility was determined by electron probe microanalysis. The solubilities determined in air using a diffusion-couple of a single crystal and a large grain-sized polycrystal are approximately 55 and 95 wt ppm at 1973 and 2073 K, respectively, much smaller than those previously determined by Roy and Coble. The cause of the large difference is attributed to the difference in the physical states of the samples. While single crystals and large grain-sized polycrystals were used in this work, powder was used in the previous work. When 400 wt ppm MgO-doped polycrystalline Al_2O_3 was annealed in air for 2.5 d at 2073 K, second phase particles of spinel precipitated at grain boundaries, especially at triple grain boundaries.

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