

Study of order-disorder transition in Pt-Ni bimetallic alloys

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The Pt-Ni alloy is an electro-catalyst of interest in the low temperature direct methanol fuel cells(DMFCs). It has been already reported that the Pt-Ni alloy catalysts may even have enhanced activity compared to pure platinum catalyst, depending on how the surfaces are prepared. The order-disorder transition in bimetallic alloy such as β -CuZn, Cu₃Au, and CuAu have been investigated greatly by x-ray diffraction. After annealing the bimetallic alloy, the crystal structure changes as observed in the order-disorder transition of Cu₃Au which changes from the face centered cubic to a simple cubic structure. Pt-Ni bimetallic alloy has been already reported to have the face centered cubic structure. However, in nano-scale Pt-Ni bimetallic alloy crystals the crystal structures changes to a simple cubic structure.

In this experiment, we have studied the order-disorder transition in Pt-Ni bimetallic nanocrystals. Pt/Ni thin films were deposited on sapphire(0001) substrates by e-beam evaporator and then Pt-Ni alloy were formed by RTA at 500, 600, and 700°C in a vacuum environment and Pt-Ni nano particles were formed by RTA at 1059°C in a vacuum environment. We measured the structure of Pt-Ni bimetallic alloy films using synchrotron x-ray diffraction and SEM.