

# Search for Nucleation of Phase Embryos in Binary Alloys by Impurity Atoms

Gary S. Collins, Luke S.-J. Peng, and Matthew O. Zacate

Dept. of Physics, Washington State University, Pullman, WA 99164, USA

Reprint requests to Prof. G. S. C.; Fax: +1-509-335-7816; E-mail: collins@wsu.edu

Z. Naturforsch. **55 a**, 129–133 (2000); received August 25, 1999

*Presented at the XVth International Symposium on Nuclear Quadrupole Interactions,  
Leipzig, Germany, July 25 - 30, 1999.*

A search was made to detect the possibility that individual impurity atoms in two-phase, binary alloys nucleate embryonic crystals. The alloy system studied was Ni-Al and the impurities were  $^{111}\text{In}$  probe atoms. Local surroundings of the probes characteristic of the crystal phases were detected through quadrupole interactions with  $^{111}\text{Cd}$  daughter nuclei using the method of perturbed angular correlation of gamma rays. Analysis of site fractions of the probes led to two alternative interpretations that could not be distinguished on the basis of the present measurements: 1.)  $^{111}\text{In}$  probes in the two-phase domain between  $\text{Ni}_2\text{Al}_3$  and NiAl segregate to  $\text{Ni}_2\text{Al}_3$  with a segregation energy of about 0.10 eV; or 2.)  $^{111}\text{In}$  probes nucleate embryonic crystals of  $\text{Ni}_2\text{Al}_3$ , with the driving force for nucleation being an attraction between In atoms and Ni vacancies that is known to be strong in NiAl.

*Key words:* Quadrupole Interaction; Phase Embryos; Solute Segregation; Perturbed Angular Correlation; Ni-Al.