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Contribution ID: **33** Type: **not specified**

Structural and Mechanical Characterization of High Temperature Shape Memory Alloys

Thursday, 23 May 2013 08:45 (30 minutes)

The NiTi alloy system has fueled significant interest for its Shape Memory and Pseudoelastic effects.The transformation temperature of the NiTi alloy family is unfortunately confined below 100 ℃ thus its application temperatures are limited.CoNiGa alloys were found to posses shape memory properties at elevated temperatures which make them promising contenders for high temperature shape memory applications.
We intend to do high resolution neutron diffraction and scan peak profiles of fundamental reflections of ten Co49Ni21Ga30 single crystals, which have been subjected to different numbers of loading cycles. We need to measure several points along the gauge length of the samples, because the accumulation of residual stresses varies along the specimen due to sample geometry. At each measuring point we will perform omega-scans and omega-2theta scans of several peaks. Martensite formation results in strong splitting of (h00)- and (hh0)-type peaks, while (hhh)-type peaks are unaffected by ferroelastic splitting. Each peak-profile will be scanned in two orthogonal chi-orientations.Finally in order to get further insight into mechanical aspect of shape memory behavior, we also intend to do a variable temperature nanoindentation tests of the Co49Ni21Ga30 alloy and try to get a structure-property correlation in the material.We will also be able to study any size effect if at all present in the system of study.

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Session Classification: Early Morning Session Thursday