ESRF	**Experiment title:** High pressure X-ray diffraction studies of U/Np alloys	**Experiment number**: **HS-3263**
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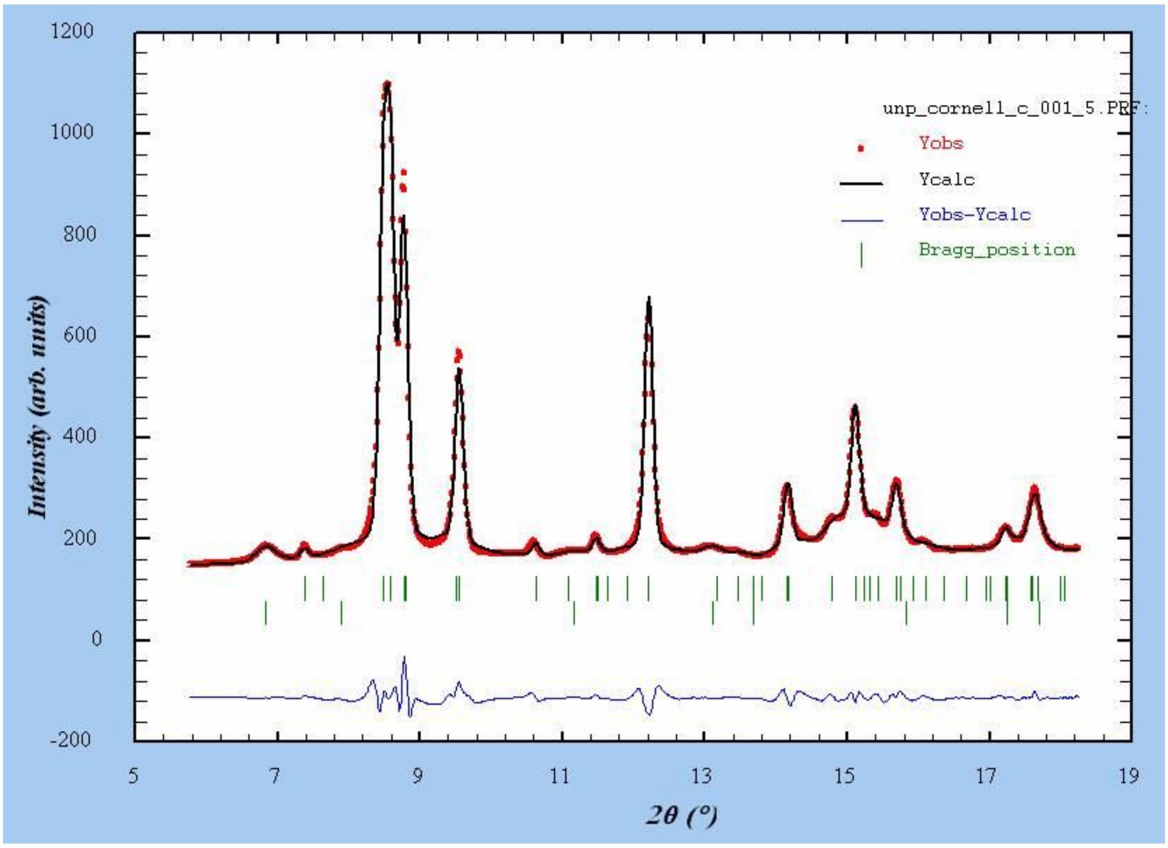
Report:

The purpose of this proposal was to perform high pressure x-ray diffraction experiments on uranium/neptunium alloys. The cells prepared for the alloy experiment were 2 Cornell type and 2 Syassen/Holzapfel type. Diamonds with culets of 100 microns and steel T301 gaskets with 40-50 micron holes were used for the Cornells. For the other cells we used diamonds with 200 and 300 micron culets with Inconel gaskets drilled to 80 and 100 microns respectively. 50 micrograms or less of the ($U_{0.4}Np_{0.6}$) alloy was loaded into each cell along with silicone oil as the pressure transmitting medium. 2 to 5 micron diameter ruby spheres or copper powder were loaded alongside the alloy samples for pressure determination.
All the experiments were performed at high energy using a micro focussed beam of 2.5 microns at a wavelength of 0.3738 Å with diffraction data collected on a MAR 165 CCD detector. Sample to detector distances were varied according to the output aperture in 2-Theta of each type of pressure cell. The exact sample to detector distance, geometry, detector tilt, beam center etc. were determined by the use of a standard LaB_6 sample.

$U_{0.4}Np_{0.6}$ alloy
For the ($U_{0.4}Np_{0.6}$) alloy we were able to cover the entire pressure range envisaged up to 100 GPa using 3 of the 4 pressure cells collected in over 100 pressure steps. Data quality was excellent over the entire pressure range. This alloy is reported to have a complex so called exotic-cubic structure known as the delta phase which is different to that of either pure uranium or neptunium and it was expected that under pressure this would transform to one of its neighbours structures or to one of the known high pressure structures such as Am III or Am IV. The U/Np delta phase structure has also been identified in the zeta phase of Pu/U alloys.



Analysis of the spectra (example shown above) revealed that only the alpha uranium structure was present in the alloy along with some diffraction lines from NpO_2 and we observed no phase transition up to the maximum pressure of 100 GPa. Neither of the 40 or 50% uranium containing alloys we studied showed any trace of the expected delta phase and different sample preparation techniques will now have to be tried to see if this delta phase is really stable in U/Np alloys. Further analysis of the data collected on ID27 will reveal if there is a difference in compressibility between the U/Np alloy and pure alpha uranium.

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