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## **Synthesis and characterisation of rare Ce<sub>3</sub>NbO<sub>7</sub> compounds for use as nuclear space batteries by neutron powder diffraction and X-ray absorption spectroscopy**

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Ce<sub>3</sub>NbO<sub>7</sub> weberite-type materials, an inactive analogue for Am<sub>3</sub>NbO<sub>7</sub>, have potential use in americium radioisotope thermoelectric generators to be developed by the European Space Agency for scientific missions beyond the orbit of Jupiter. Ceramics with greater than 97% purity were synthesised by thermal solid-state reaction and analytically characterised by X-ray diffraction, neutron diffraction, helium pycnometry, Raman spectroscopy and X-ray absorption spectroscopy. The Magnetochemistry of the system was calculated with the Weiss temperature and magnetic moment per unit volume derived, in good agreement against the theoretical values. Reitveld refinement of neutron data was employed to identify the crystal structure of the novel cerium niobate and determine the correct orthorhombic space grouping from either Cmc<sub>2</sub>m (No.63) or Pnma (No.62) space groups. Ce<sub>3</sub>NbO<sub>7</sub> refined well under both systems indicating possible pseudosymmetry. Cerium in the +III oxidation state was observed by X-ray absorption spectroscopy confirming the chemical speciation within the structure.

### **Summary**

Designing space batteries from UK reprocessed plutonium stockpiles.

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