

## Application 2030



### **Hydrogen absorption in Nb<sub>4</sub>Co<sub>1-x</sub>Ni<sub>x</sub>Si**

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Nb<sub>4</sub>CoSi and Nb<sub>4</sub>NiSi, crystallising with the Al<sub>2</sub>Cu-type structure, space group I4/mcm, absorb considerable amounts of deuterium at room temperature and 90-kPa deuterium pressure. The deuterium contents for the pure compounds were determined to be Nb<sub>4</sub>CoSiD<sub>2.5</sub> and Nb<sub>4</sub>NiSiD<sub>2.7</sub> from neutron powder diffraction. In the pure compounds, two crystallographic sites, 4b and 16l, are occupied by deuterium to 78.2(6)% and 12.2(3)% in Nb<sub>4</sub>CoSiD<sub>2.5</sub> and 63.6(8)% and 18.6(5)% in Nb<sub>4</sub>NiSiD<sub>2.7</sub>. Each deuterium atom coordinates four niobium atoms in a tetrahedral arrangement.

In the proposed project we will investigate samples in the composition range Nb<sub>4</sub>Co<sub>1-x</sub>Ni<sub>x</sub>Si, 0.1 < x < 0.9. These solid solutions are unknown from a hydrogen absorption point of view. Deuterated samples in powder form will be investigated with respect to crystal structure and hydrogen storage properties. Furthermore, the undeuterated samples become superconductors at low temperatures (~7K). The effect of hydrogen/deuterium on the superconducting properties will be evaluated and the low temperature structure will be investigated from low temperature neutron diffraction measurements.

We propose to measure three samples in the composition range Nb<sub>4</sub>Co<sub>1-x</sub>Ni<sub>x</sub>Si, 0.1 < x < 0.9. Furthermore, these samples will be measured with varied hydrogen/deuterium content, giving a total of 6-8 measurements. The samples absorb hydrogen/deuterium readily at room temperature so it would be possible to start from a undeuterated sample and then increase the hydrogen/deuterium content stepwise and investigate structural transitions as a function of hydrogen/deuterium content.

These measurements will be performed in collaboration with Magnus Sörby at the Institute for Energy Technology, Physics Department in the EU infrastructure project H2FC.