Neutron imaging study of the phase separtation of ^{3}He-^{4}He liquid mixtures at low temperatures

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Liquid ^{3}He-^{4}He mixtures have been of technical importance for obtaining very low temperatures, mainly because dilution refrigerators, which are widely used for cooling in the miliKelvin range, are based on their properties. One major advantage is the possibility to vary ^{3}He concentration and thus the isotopic phase separation temperature.
We have performed a set of neutron imaging experiments on ^{3}He-^{4}He mixtures, where x_3 (^{3}He concentration) was 9.7%. The predicted phase separation temperature, T_{ps} is ∼300 mK which turned out to be in a very good agreement with the experimental value ∼294 mK. Images, in the temperature range of from 1.5 K to 150 mK, were taken for 18 hours, with 30 second time intervals, using a high resolution CCD camera.
The results have clearly shown two distinctly separated phases, ^{3}He-phase on the top of ^{4}He-phase. In addition, the dynamics of ^{3}He atoms during the phase separation process has been studied.