

Phase diagram of superfluid ^3He in 10% uniaxially compressed aerogel

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We measure the pressure dependent superfluid fraction of ^3He entrained in axially compressed 98% open aerogel using a torsion oscillator. The aerogel was grown in a slab geometry and compressed axially by 10% to a $400\ \mu\text{m}$ height. We observe an enhanced region of the temperature-pressure phase diagram to be occupied by a metastable A phase all in zero applied magnetic field. Crucially we observe the reappearance of the A phase upon warming from the B phase before the superfluidity of the “dirty” ^3He is extinguished at the suppressed T_c , in contrast to the coincidence of the B to A transition with T_c upon warming in uncompressed aerogel. The re-entrant A phase is seen to extend well below the polycritical pressure. The A to B transition (observed while cooling) and the B to A transition (sampled by “turnarounds”) exhibit finite widths in temperature. The presence of this region of reentrant A phase (between the normal and dominant B phase) that is enhanced by the anisotropic disorder of the compressed aerogel together with the disappearance of the polycritical point are the principal modifications of the phase diagram from its bulk form. However the expected alignment of the A phase texture by compression of the aerogel is not observed in the measured superfluid fraction.