Parallel Plates for Surface Magnetization Measurements of Superfluid ^{3}He

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We have carried out a series of measurements on the transverse acoustic impedance (Z)[1] of the superfluid ^{3}He and confirmed the existence of the surface Andreev bound states (SABS) inside the superfluid energy gap experimentally. We also have found a broadening of the SABS band and an extra low energy peak in Z as we increased the specularity towards the specular limit. Recently, it was claimed theoretically that the SABS of the superfluid ^{3}He B phase are Majorana fermions and the growth of the new peak is a strong indication of the Majorana cone at the specular limit[2,3].
To confirm the Majorana property further, we are planning to study the anisotropy in magnetic susceptibility of the SABS with respect to the external field which comes from the Majonara nature by NMR measurement. Since the SABS is confined to narrow region within some coherence lengths (ξ_0) from the wall, we have to increase the surface area to obtain enough surface signals over a bulk liquid one.
We invented a clever method and succeeded in fabrication of 150 parallel plates with 2.5-μm slabs[4]. We stretched sheets tight to keep sheet gaps and stacked them in layers to gain higher homogeneity of the slab thickness. Our average sheet gap was 2.50 ± 0.02 μm and the gap distribution was narrower than previously used ones.

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