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Superfluid ^{3}He is a spin-triplet *p*-wave superfluid which was found for the first time as an anisotropic superfluid and its bulk properties are well established by previous researches. The superfluid ^{3}He B phase under zero magnetic field is categorized as a time-reversal invariant topological superfluid (DIII class) and the surface Andreev bound states (SABS) are formed inside the superfluid energy gap which is conceptually understood by the bulk-edge correspondence. The SABS satisfy the Majorana condition that a particle and its antiparticle are equivalent.

So far, our experimental group has carried out a series of measurements of the transverse acoustic impedance, $Z = Z' + iZ''$, and clarified the existence of the SABS inside the superfluid energy gap experimentally. *Z* probes the transverse momentum exchange between ^{3}He quasi-particles and a wall spectroscopically by setting the frequency comparable to the gap energy. Our experimental group also found an extra low energy peak in *Z* as the specularity of the wall was increased towards the specular limit. Based on the theoretical model, the new peak was identified a clear sign of the linear dispersion of the SABS in the specular limit. The experimentally observed dispersion relation linear to the momentum of the SABS means the observation of the formation of a surface Majorana cone. Majorana fermion has not been found yet in the elementary particle physics, but it will give a great impact if the quasi-particles in the SABS of the superfluid ^{3}He B phase are confirmed to have the Majorana properties.

The time-reversal invariance is broken by the magnetic field when it is applied perpendicular to the wall, and the superfluid ^{3}He B phase becomes topologically trivial. As a result, it was shown theoretically that a gap corresponds to the Zeeman energy (Δ_{Zeeman}) opens up in the surface density of states (SDOS) at the Fermi energy, and the peak of the SDOS near the bulk energy gap should be distorted in the range of $\Delta \pm \Delta_H$. Moreover, Δ_{Zeeman} should not appear under the magnetic field which is applied parallel to the wall below the dipolar field (～3 mT). This anisotropic behavior is regarded as the reflection of Majorana properties.

In order to investigate the magnetic response of the SDOS, we measured *Z* under various magnetic fields which are applied perpendicular to the wall. Since we expected that the SDOS near the Fermi energy at the specular limit is too small to detect the effects of Δ_{Zeeman} due to the linear dispersion relation, we decided to measure *Z* at the diffusive limit. The peak in Z'' which appears under zero magnetic field at 41.06 MHz was smeared out at magnetic fields higher than 50 mT due to the distortion of the bulk energy gap. Some characteristic structures which did not appear under zero magnetic field were observed and the temperature where the structures appear ($T_{structure}$) shows the linear magnetic field dependence. By choosing the resonant frequency at 13.63 MHz, we were able to observe the low energy magnetic response which was not observed in the previous measurements at 41.06 MHz. The structure iii observed in the measurements at 13.63 MHz is the biggest among all of these structures and shifts to the lower temperature at higher field.

Through the discussion of the magnetic field dependence of the energy at $T_{structure}$, we found that the situation $\hbar\omega = \Delta(T) - \Delta_H(H, T) - \Delta_{Zeeman}(H, T)$ was satisfied at T_{iii}. Finally, we were able to calculate the magnetic field dependence of Δ_{Zeeman} from this relation and the theoretical hypothesis that Δ_H depends not only on the magnetic field but also on the temperature, due to the temperature dependence of the bulk susceptibility. We also found that Δ_{Zeeman} is about two times larger than Δ_H. Thus, we successfully showed that the magnetic field does open up a gap at the Fermi energy of the SDOS for the case of the diffusive limit, when the field is applied perpendicular to the wall.

We tried to look for the anisotropy of the SDOS under the magnetic fields related to the Majorana properties. We performed the measurement in 2 mT, which is smaller than the dipolar field, but we were not able to observe the structure iii or any other structure. The measurement of Z under relatively high field which is applied parallel to the wall is undergoing to check whether the structure iii disappears or not.

In summary, we were able to show the Δ_{Zeeman} to open in the SDOS under the magnetic field when it is applied perpendicular to the diffusive limit wall experimentally. Furthermore, the magnitude of Δ_{Zeeman} is about twice that of Δ_H. This means that the superfluid ^{3}He-B is definitely a topological superfluid which is protected by the time-reversal invariance.