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Enhanced microwave absorption in fine grains of alkali fulleride superconductors[1]

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Electrodynamics of superconductors remains an intensively studied field due to the wealth of attainable fundamental information, including the nature of pairing meachanism and the coupling strength, and also due to the technological importance of these materials. In particular, the AC electrodynamic properties are relevant for high frequency applications including sound, electromagnetic field detection, superconducting microwave resonators, or in microwave absorber applications. Herein, we report a microwave observation which is larger than that in the normal state on fine grains of type-II superconductors (K_3C_{60} and MgB_2) for magnetic fields which are as small as 2 % of the upper critical field, B_{c2}. We employ the so-called microwave cavity perturbation method where changes in the cavity quality factor, Q, and resonance frequency, f_0, accurately probe the material properties. The effect is predicted by the Coffey-Clem (CC) theory of vortex motion in type-II superconductors, however its direct observation has been elusive due to skin-depth limitations; conventional microwave absorption studies employ larger samples where the microwave magnetic field exclusion due to the Meissner effect significantly lowers the absorption. We show that for samples consisting of sufficiently small grains, the predicted effect is observable and that the real part of the microwave conductivity, σ_1, becomes *larger* below T_c than in the normal state for moderate magnetic fields.

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