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C2Po1F-06: Experimental study on single-stage adiabatic demagnetization refrigerator (ADR) with Chromium Potassium Alum (CPA)

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As a good paramagnetic material with low magnetic ordering temperature, CPA is often used in the study of ADR. A typical ADR consists of a multitude of components such as the salt pill, superconducting magnets, heat switch, etc. To study the performance of CPA in the single-stage ADR, an experimental system had been built. It used a two-stage GM refrigerator to provide ADR with a low-temperature environment of less than 4K. A 1.2K superfluid helium bath was connected to the ADR, and they were controlled by a mechanical heat switch to turn on and off. We have already conducted preliminary experiments, using superconducting power provides a magnetic field. In the first experiment, CPA was pre-cooled to 1.95K, demagnetized from 2T, and the lowest temperature obtained was 460mK. We conducted a second experiment after optimizing structures such as the heat switch and suspension, CPA could be pre-cooled to 1.65K. It was demagnetized from 1T and 2T, respectively, and the lowest temperatures obtained were 359mk and 321mK. Through experiments, we have identified the factors that influence cooling and are further optimizing them in subsequent work.

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