Answer on Question #52203-Physics-Molecular Physics-Thermodynamics

What is adiabatic demagnetization? Explain how low temperatures are produced using adiabatic demagnetization?

Answer

A sample of the paramagnetic salt is suspended by a thread in a tube filled with helium gas under slight pressure. Helium gas provides contact with a bath of liquid helium cooled liquid evaporation under reduced pressure. While working in the bath is maintained at a lower pressure may typically corresponding to a temperature of $\sim 1\ K$.

Due to the thermal conductivity of the gas paramagnetic salt is cooled to the temperature of the helium bath. Then the magnetic field is switched on.
In the process of magnetization heated salt. Orientation of the magnetic ions along the magnetic field reduces the entropy. Heat from the salt is given in the helium bath temperature and salt again becomes 1 K.

Further, the gas that surrounds the sample and stored with it in thermal contact, and then pumped off a magnetic field is produced. In the process of adiabatic demagnetization of entropy and energy of magnetic ions is partially reduced by the energy of the lattice, and the temperature of the salt significantly reduced.

For very low temperatures are most suitable salt with a low concentration of the paramagnetic ions, i.e. salts in which adjacent paramagnetic ions are separated by nonmagnetic atoms. The interaction between magnetic ions in this case is very weak. For example, in chromium-potassium alum each magnetic chromium atom is surrounded by 47 neighbors nonmagnetic.