

Anneal Summary

The number of paramagnetic radicals in the material must be carefully balanced to achieve the greatest polarization. Although the free electrons from these paramagnetic centers are necessary to polarize via DNP, they also allow polarization decay short-cuts for the aligned protons. As radiation dose from the beam produces more radicals than needed, the DNP process becomes less efficient and the polarization will fall. However, by heating the ammonia, we can allow some of these radicals to recombine. This heating is called an "anneal", and for an experiment that runs at 80nA beam current, will likely be necessary every day. After an anneal, the polarization can again reach maximal levels. There is a limit to the lifetime of the ammonia however. As successive anneals are performed on a material sample, the decay rate of the polarization will increase, requiring more anneals per day. This is due to the buildup of radicals which cannot be recombined in an anneal. Eventually, the polarization decay rate will be so fast that it is no longer practical to use the material, so a new ammonia sample will be used. This replacement of material will occur once a week.