

Reusable Coil Setup For High Pressure Magnetic Properties Studies

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In the past years, Almax easyLab developed the Diacell ® ChicagoDAC in collaboration with Daniel Silevitch's group [1]. This diamond anvil cell is dedicated to high pressure - low temperature electrical resistivity measurements. Here we present a new application of the Diacell ® ChicagoDAC. We have developed a coil setup in order to carry out magnetic measurements at low temperature and high pressure. This new development makes this diamond anvil cell a very powerful tool to study electrical and magnetic properties of materials at high pressure with the advantage that pressure can be tuned while measuring at low temperature.

The primary pick up coil (detection) was wound using 25 μm enameled copper wire with a coil winding machine. This detection coil is located at the center of a coil former made of PEEK material. It is circular and surrounding the sample once positioned into the DAC. The primary drive coil (excitation) was wound outside the detection coil (see details in table 1 and figure 1). Both coils are thus inside the coil former and secured by GE varnish at the end of the coiling process. With this experimental setup, it is possible to use the same coils for several high pressure experiments.

Coil Type	Number of turns
Primary Pick up coil	600
Primary Drive coil	1400
Compensation Pick up coil	600
Compensation Drive coil	1400

Table 1. Specifications of the coils made with 25 micron enameled copper wire, used in the Diacell ® ChicagoDAC.

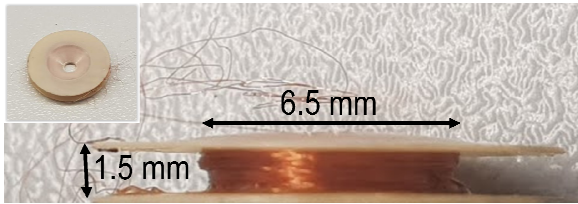


Figure 1. Overview of a PEEK coil former wound using 25 μm enameled copper wire. The inner pick up coil (detection) has 600 turns and the outer drive coil (excitation) has 1400 turns. Inset: Top view of the PEEK coil former with the pickup and drive coils inside.

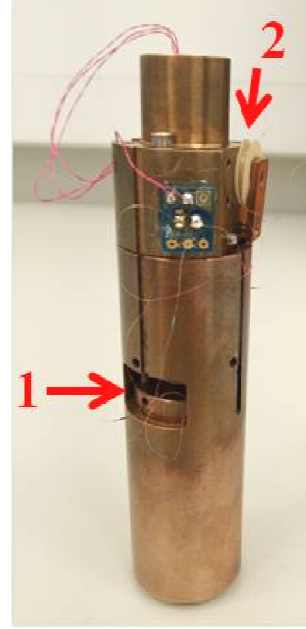


Figure 2. Overview of the Diacell ® ChicagoDAC mounted with the primary pickup and drive coils inside the DAC (1), and the compensation pickup and drive coils outside the DAC (2) before a high pressure measurement.

A second coil former with the same characteristics is used outside the cell as compensation coils (see figure 2).

In this paper, we will present the experimental details of the setup as well as our preliminary results obtained on a Ferro and Antiferromagnetic sample (Heusler alloy type) at high pressure and low temperature.

These results are promising for this setup and further development on the coils will lead to higher sensitivity, opening the possibilities of detecting low signal samples.

- [1] Y. Feng, D.M. Silevitch, T.F. Rosenbaum, *Review of Scientific Instruments*. 2014, **85**, 033901.