High Sensitivity Measurement of a Copper Complex by ESR

Copper exists widely on earth, and is known to have many functions. It forms a stable ion, Cu^{2+}, of electronic configuration $3d^9$, so it is good for ESR measurements. At high concentration, measurement at room temperature is possible, but when structural analysis is needed, it is normal to use dilute solutions and measure at low temperature.

Here, we will show measurement of a copper protein extracted from natural marine products. As the copper content is extremely small and isolation is difficult, the observed signal intensity at 77K using an insertion Dewar (ES-UCD3X) was too weak to analyze as shown in Fig. 1.

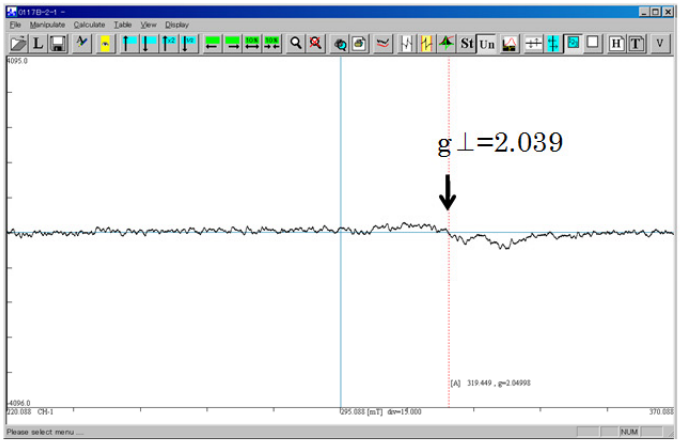
The measurement was repeated at 20 K using the ES-CT470 liquid helium attachment. As shown in Fig. 2, the g-tensor (g //, g ⊥) characteristic of Type II copper complex*, was observed.

Using parameters obtained from this, a simulation which closely matches the measured spectrum was obtained as shown in Fig.3.

In general with ESR, the lower the sample temperature, the higher the measurement sensitivity becomes.（Refer to ESR Application Note ER-080003)

This example shows that for small sample amounts, measurement at very low temperatures can be very useful. There are elements such as Fe3+ where ESR sensitivity is higher than ICP-MS. The sensitivity improvement is particularly useful for metal compounds, and measurement using the ES-CT470 is recommended.

（Isotropic and Anisotropic simulation are supplied in FA series software as standard.)



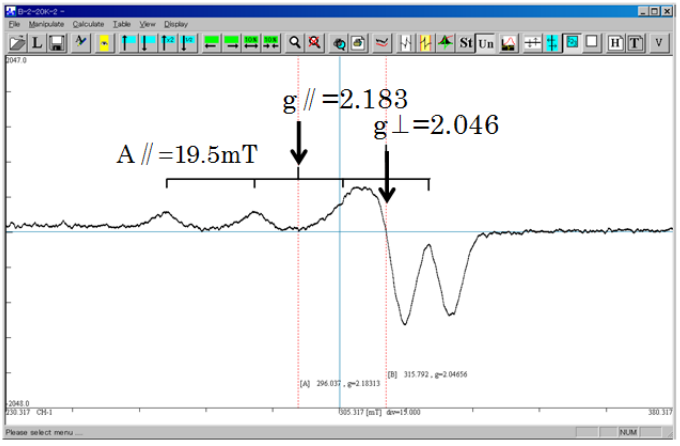


Fig.2 Result of Natural Copper Protein at 20K.

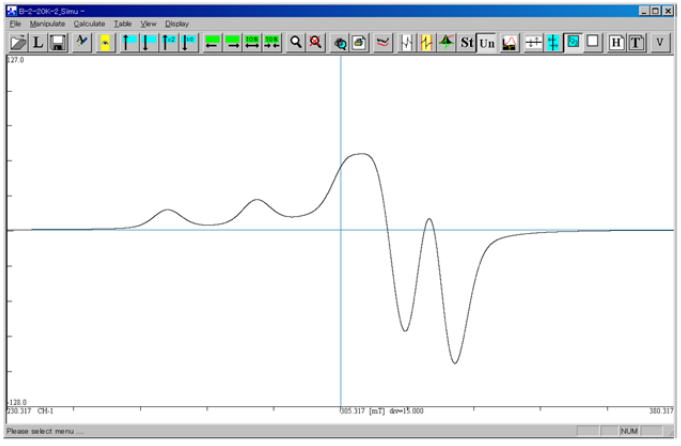


Fig.3 Simulation Result of Natural Copper Protein

* : The Actual ESR Spectrum Hiroshi Sakurai, Hirokawa Shoten Co, Chemistry Series 51 (1988)

Sample Courtesy of : Nichiro Corporation（present Maruha Nichiro Holdings, Inc.)