

## Introduction of Loop-Gap Resonator - No. 2

Paramagnetic substances experience a magnetic interaction when in contact with oxygen molecules. If the frequency of contact with oxygen is large, then this exchange interaction becomes large and it leads to the increase of line widths and shortening of relaxation times. The frequency of contact when oxygen becomes high when: (a) the dissolved oxygen concentration in the solvent is high, or (b) the oxygen concentration in the space above the paramagnetic sample is high. The secondary structure of proteins using ESR is calculated using line widths and the saturation factor both when oxygen is dissolved in the solvent, and when oxygen is displaced from the solvent (by substitution with N<sub>2</sub> or Ar)<sup>(1)</sup>. Using the Loop-Gap Resonator, the saturation curve can easily be measured even using weak microwave irradiation. (It is possible to use this resonator with a TPX capillary\*). In the case of an aqueous solution of TEMPOL contained in a TPX capillary, the displacement of oxygen by nitrogen can be completed in about 2 minutes.

### Measurement Example

A TEMPOL solution (10<sup>-4</sup>M in water) was sealed in a TPX capillary and the microwave saturation characteristics were measured both with oxygen dissolved in the solvent, and when oxygen was displaced from the solvent by nitrogen (Fig1). With oxygen in the solution, it is obvious that it is difficult to saturate due to the magnetic interaction. Conversely, when oxygen was displaced from the solution by nitrogen gas, it was easy to saturate due to lack of magnetic interaction.

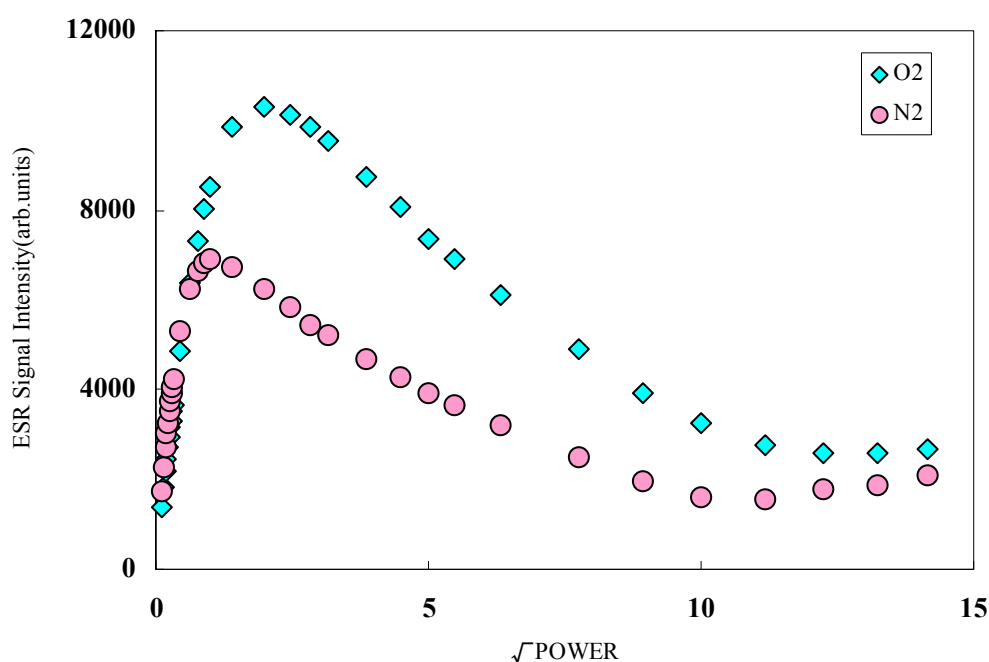


Fig. 1. Microwave Power Saturation Curve of TEMPOL Solution

\*Resin Capillary of Gas Permeability

### Cited Literature

- (1) Lawrence J. Berliner, Sandra S. Eaton, Gareth R. Eaton (2000): Biological Magnetic Resonance, Vol.19, Kluwer Academic/Plenum Publishers, pp614.