

ESR sample preparation

Product used : Electron Spin Resonance (ESR)

■ Classification of measurement sample

The samples for ESR analysis can be measured under various conditions, including solid, liquid, and gas phases. In actual ESR measurements, it is important to perform sampling tailored to the characteristics of the sample. The selection of a suitable sample tube is important, considering the shape and the solvent of the sample. Initially, the sample needs to be classified as solid, liquid, or gas. For solid and liquid samples, the appropriate sample tube can be selected by criteria Table 1.

Table1. Classification of measurement sample and selection of sample tube

Classification of measurement sample		Adaptable sample tube
Solid	① Water content greater than 10%	Small diameter sample tube, Flat tissue cell (ES-LC20) There is also a method of drying and sampling with standard sample tubes.
	② Water content less than 10%	Standard sample tube
	③ Conductive sample	Small diameter sample tube, Capillary tube
Liquid	④ Aqueous or alcoholic solution	Aqueous sample cell (ES-LC12), Capillary tube
	⑤ Polar solvent sample other than ④	Small diameter sample tube, Capillary tube
	⑥ Non-polar solvent sample	Standard sample tube

※In the case of a solution sample, it is also possible to freeze it and observe the solid ESR signal.

■ Adjusting sample amount

The sample length that is allowed to be measured with ESR depends on the cavity, and the measurement result will not change even if a longer sample is introduced. For accurate quantitative comparisons of multiple samples, errors can be minimized by adjusting the sample amount to be the same. For samples with high unpaired electron quantity, or high conductivity, or significant dielectric loss, it may be difficult to observe ESR signals if a large amount is collected. In this case, it is necessary to reduce the sample amount in the sample tube. The amount of powder samples may vary depending on the sampling method. It is recommended to adjust the particle size to be the same or pack the sample with uniform density to achieve highly quantitative measurements. For samples with no dielectric loss, by measuring a large amount of sample with a large-diameter sample tube, you can obtain a stronger signal than using a standard sample tube.

Table 2 summarizes application notes related to items that need to be considered when measuring ESR. For additional details on various sample tubes, please refer to the Electron Spin Resonance Spectrometers Attachment Brochure.

Table 2. Application notes

Category	Application note
Sample preparation ① ~ ③	ER230004E ~ ER230006E
ESR measurement condition	ER220001E / ER220003E ~ ER220005E / ER230008E
Linear change in ESR signal depending on sample condition	ER220002E / ER220006E / ER210002E