Paramagnetic vacancy of synthetic quartz glass

Product used：Electron Spin Resonance (ESR)

■ E' center signal

When the synthetic quartz sample tube is irradiated with ultraviolet rays, ESR signal due to defects is observed (Figure 1). This paramagnetic vacancy in the quartz glass is called the E_1' center which has one electron at the center [1]. Several types of E' centers with different generation mechanisms have been reported so far. In addition, E_1' center signal is observed by the mechanical stress as well. This signal is measured at low microwave power because of its long relaxation time. ESR signal intensity of this center varies depending on the raw material and the manufacturing process.

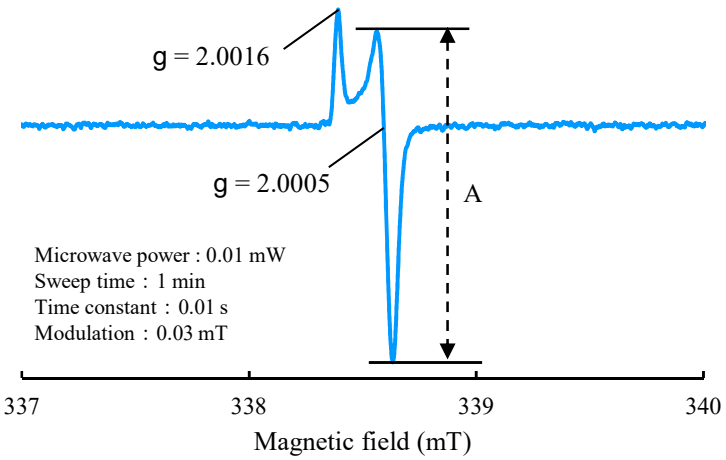

Figure1. The E_1' center signal of the quartz sample tube by ultraviolet irradiation.

■ Dependence of E_1' center signal on intensity and time of UV irradiation

In Ultraviolet Radiation Apparatus (ES-13080UV2A / ES-13090UV04), UV irradiation intensity can be entered numerically. Figure 2 shows the time dependence of the E_1' center signal intensity (A in Figure 1) when the sample tube is irradiated with different intensity by ES-13080UV2A light source. It can be seen that the longer the irradiation time and the higher the irradiation intensity, the higher the E_1' center signal intensity. When performing ESR measurement while irradiating the sample with ultraviolet rays, it is necessary to confirm that the E_1'center signal derived from the sample tube does not affect the ESR signal of the target paramagnetic species.

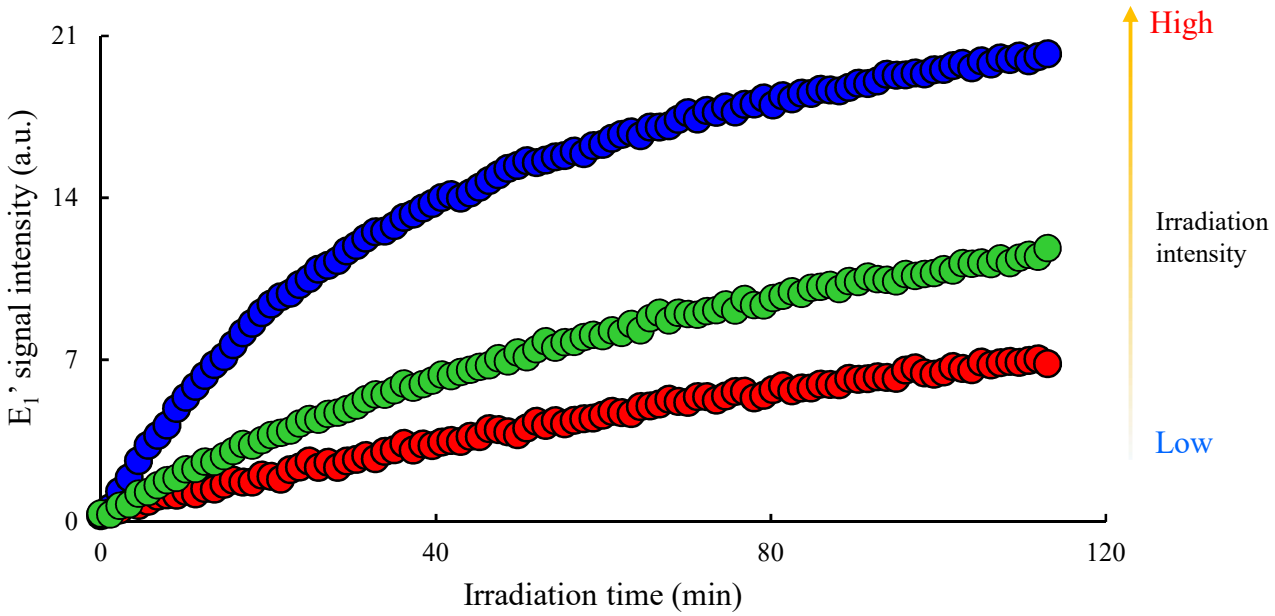

Figure 2. The E_1' center signal intensity plotted against the irradiation time.

【Refference】

[1] R.Weeks, J. Non-Cryst. Solids,179,1(1994).

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