

ESR of materials – Pigment (1)

Product used : Electron spin resonance (ESR)

■ Pigment

Pigment powder is used for coloring and is insoluble in water and oil. It is utilized to color paints, synthetic resins, cosmetics, and foods. Pigments are divided into two categories: inorganic and organic. Inorganic pigments encompass those processed from natural minerals and chemically synthesized pigments. Organic pigments, on the other hand, are made from organic compounds.

■ ESR signal of pigment

An acrylic paint contains pigments, constituting a mixture of pigments, water-soluble resins, and surfactants. Ultramarine, phthalo blue, and manganese blue phthalo were used as measurement samples. ESR measurements were conducted at room temperature. The ESR signal of ultramarine was observed at $g = 2.03$ (Figure 1 (A)), which has been reported to originate from the sulfur radical (S^{3-}) [1]. Broad ESR signals were observed for phthalo blue and manganese blue phthalo and were attributed to Cu^{2+} and Mn^{2+} based on their g -values and line shapes (Figure.1 (B) and (C)). These metal ions are considered to originate from phthalocyanine pigments contained in each sample. Although the types of metal ions contained in phthalo blue and manganese blue phthalo are similar, their quantities and mixing ratios are different. This information can be utilized to deduce clues for estimating the pigments used in paintings and murals, as similar colors can possibly be distinguished by the ESR signals of pigments.

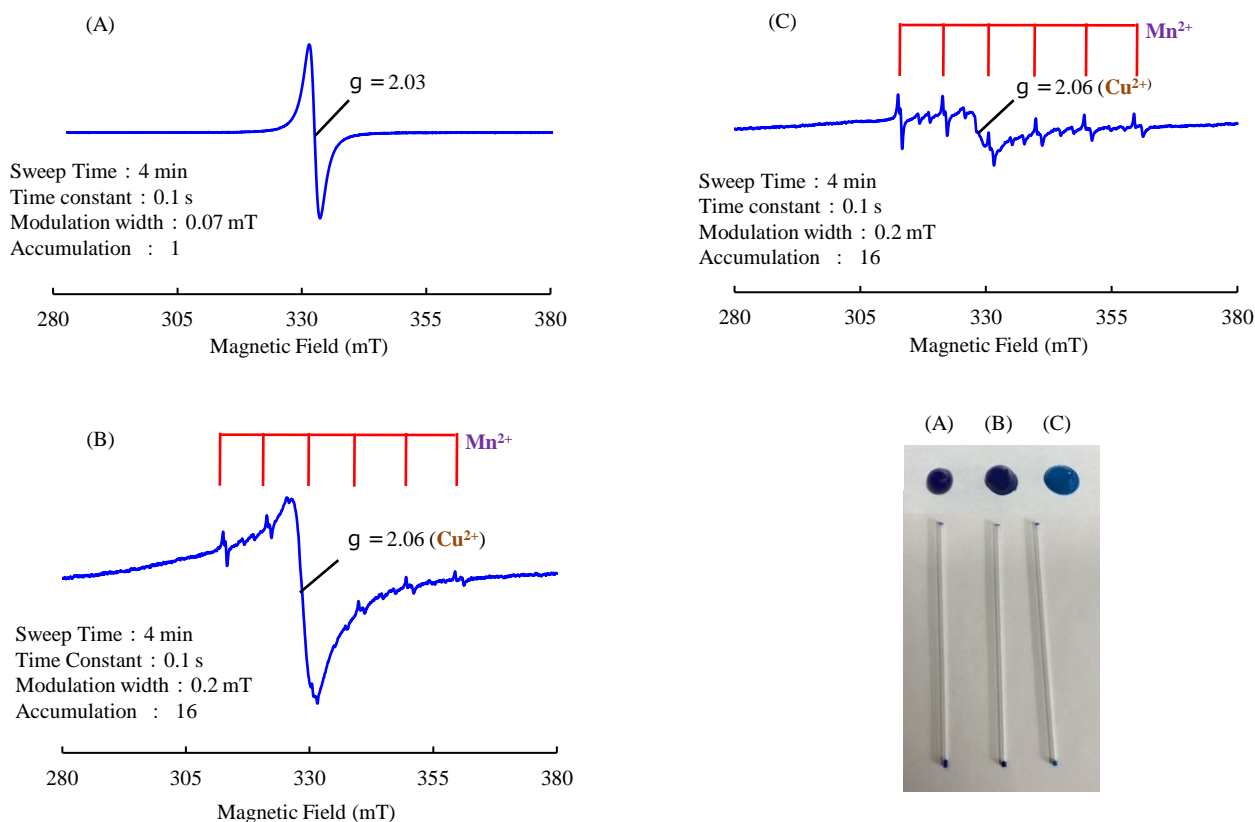


Figure 1. ESR signals of pigments

(A) Ultramarine (B) Phthalo Blue (C) Manganese Blue Phthalo

Reference

[1] B. Andrzej et al. (1999) : Temperature dependence of the EPR line width of ultramarine blue, *Magnetic Resonance in Chemistry*, 37, S150-S153.