Exercice 7.1: Reflectance properties of different crystal sizes

The reflectance spectra of copper sulfate for different crystal sizes are shown in Fig. 1. The reflectance spectra of potassium permanganate for different crystal sizes are shown in Fig. 2. Note that the reflectance spectra here take into account both diffuse and specular reflectance.

1) Is copper sulfide a weak or a strong absorber in this spectral range? Explain why.
2) Is potassium permanganate a weak or a strong absorber in this spectral range? Explain why.

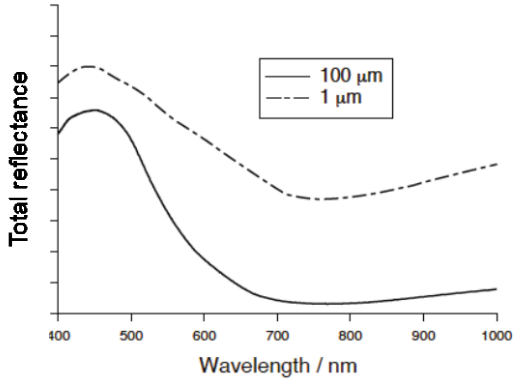

Figure 1 : Total reflectance spectra for copper sulfate at different particle sizes

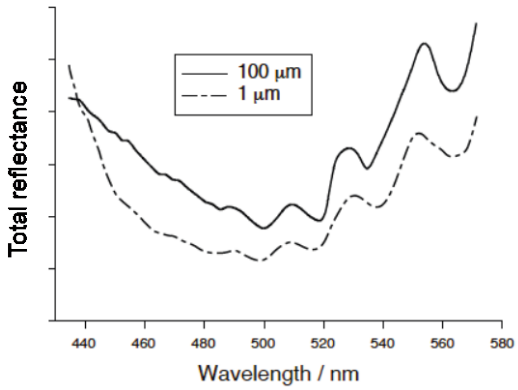

Figure 2 : Total reflectance spectra for potassium permanganate at different particle sizes

Exercice 7.2: Kubelka-Munk function

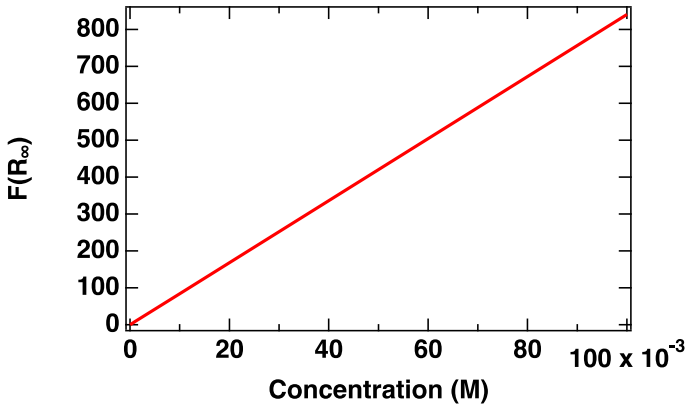

Figure 3 : Kubelka-Munk function at 264 nm as a function of concentration for grinded colored glass.

Fig. 3 shows the Kubelka-Munk function at 264 nm of 1% coloured grinded glass dispersed in a matrix that does not absorb at the wavelengths we consider. Knowing the scattering coefficient of the matrix (s = 0.1 cm^{-1}), estimate the molar extinction coefficient of coloured grinded glass at 264 nm.

Exercise 7.3: Ellipsometry

1) Why are transparent media difficult to characterize by ellipsometry?

2) What is the consequence of roughness on ellipsometry measurements?

3) Can you measure optical constants of a multilayered material? If the answer is yes, what are the additional precautions to account for?

4) How can the thickness of a thin film be determined by ellipsometry ? Discuss the cases of both weakly and highly absorbing materials.