OPTICAL SPECTROSCOPY OF PtOEP IN PULSED MAGNETIC FIELDS TO 55 T

Brian Crone, Ian Campbell (MPA-11, Los Alamos), Scott Crooker (NHMFL-LANL), D. L. Smith (T-11, Los Alamos)

Introduction

Conjugated organic materials (e.g., polymers) are of interest for spintronic devices because they have very weak spin-orbit coupling and hyperfine interactions, which leads, in principle, to long spin coherence lifetimes. Spintronics relies on the generation, manipulation, and detection of non-equilibrium spin distributions in non-magnetic materials. However, the same weak spin-orbit interaction in organic materials also precludes the possibility of using optical techniques to inject and detect spin-polarized carrier densities – tools which have been used to much advantage in III-V semiconductors. By utilizing metal-organic compounds which incorporate heavy metals and introducing them into organic materials, we hope to 'turn on' spin-orbit coupling, and perhaps the possibility for optical spin injection and detection. Here we study the magnetic field and temperature dependence of photoluminescence of the metal-organic compound PtOEP (a platinum porphyrin), in polymer host (here the polyfluorene PFO).

Experimental

We performed magneto-optic studies of the metallo-organic (PtOEP)/ organic host (PFO) system. Measurements consisted of photoluminescence (PL) spectra as a function of temeperature, and magnetic field for temperatures from 2.2 to 17 K and magnetic fields from 0-55 T using the NHMFL 60 T Long Pulse magnet. The field directions correspond to looking at right and left circularly polarized light.

Results and Discussion

As shown in Fig. 1a, the PL (for zero magnetic field) from the peak at 643nm increases as the temperature increases with no change for the lower energy peaks. The intensity of the photoluminescence peak at 643 nm is shown in Fig. 1b for right and left circular polarized light. As the field increases, this PL feature increases in intensity, and in addition, there is a splitting between the intensity of the right and left polarized photoluminescence.

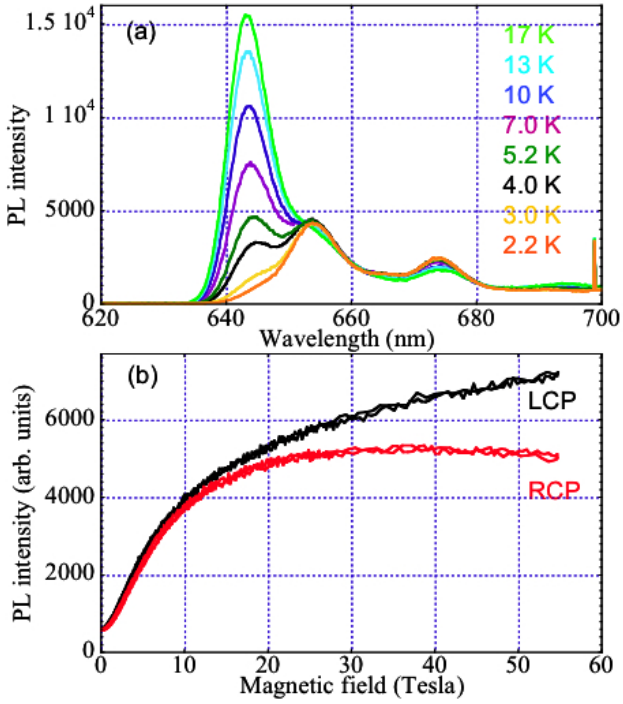

Figure 1: Photoluminescence intensity of PtOEP in a PFO host as a function of a) temperature at 0 magnetic field, and b) magnetic field at 2.2 K.

Conclusions

We have developed a theoretical model to explain the magneto-optic properties of PtOEP, which is in good agreement with the data. We are in the process of developing further experiments, for instance looking at the magneto-optics of single crystals of PtOEP or PtP in n-octane, to further our understanding of these systems.