SURFACE CHEMISTRY OF QUANTUM DOTS

By: Marina Elkommos-Zakhary, P. Gregory Van Patten

ABSTRACT

Quantum dots are tiny particles of semiconductor material that are a few nanometers in size, with optical and electronic properties that vary from the bulk material due to quantum mechanical effects. However, it has been very difficult in the past to determine for certain what ligand molecules were present on the surface of quantum dots and how many.

EXPERIMENTAL

We have begun to demonstrate the use of nuclear magnetic resonance (NMR) spectroscopy as a tool to identify and quantify ligands on the surface of quantum dots. Quantum dots are prepared with the possibility of just one ligand (onion). Next is to purify the molecules. Measurements are taken using the NMR spectra. Quantifications are done by through the addition of ferrocene. Other reactive chemicals were used to strip the ligands

RESULTS AND DISCUSSION

Specifically how many ligand molecules are on the surface will be look at intricately Our results show that the method of purification is very important in removing excess materials that are not attached to the quantum dots without stripping off the attached ligands. This is a very delicate purification method for the quantum dots.

DATA

Cadmium Selenide dissolved in D8toluene

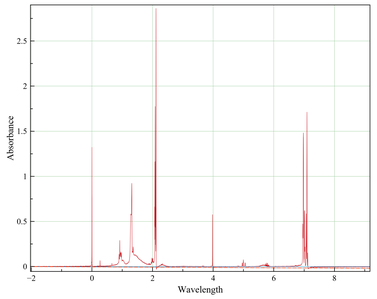

Figure 1: 1H NMR spectrum of an CdSe dispersion in toluene-d8, and 1H NMR spectrum of an oleate anion was shown as a broad peak at 1.5 ppm. The 1H NMR spectrum of ferrocene shows only one peak that accounts for the protons of both cyclopentadienyl rings, which appeared as singlet at 4.0 ppm. D8-toluene appeared as doublet at 2.2 ppm and quartet in the range of at 6.8 to 7.2 ppm.

Cadmium Selenide dissolved in HMDS

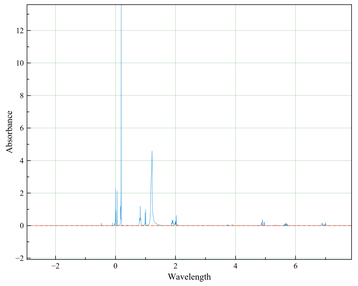

Figure 2: 1H NMR spectrum of CdSe dispersion in HMDS. The 1H NMR spectrum of ferrocene shows only one peak that accounts for the protons of both cyclopentadienyl rings, which appear as singlet in the range of 3.8 to 3.9 ppm. D8-toluene appeared in the range of 1.8 to 2.1 ppm and 6.9 to 7.2 ppm.

Cadmium Selenide dissolved in HMD

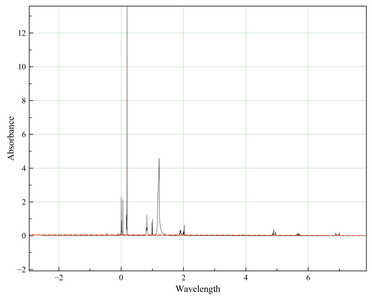

Figure 3: 1H NMR spectrum of CdSe dispersion in HMDS was scanned 1024 to show clear peaks, 1H NMR spectrum of an oleate anion was shown as a narrow peak at 1.5 ppm. The 1H NMR spectrum of ferrocene shows only one peak that accounts for the protons of both cyclopentadienyl rings, which appear as singlet in the range of 3.8 to 3.9 ppm. D8-toluene appeared in the range of 1.8 to 2.1 ppm and 6.9 to 7.2 ppm.

CONCLUSION

This method of purification should be used to purifications. It is vital to preserve the ligands attached on the quantum dots. We can conclude that the method is safe for purifying quantum dots. Ligand glands carry a lot of weight on the characteristics of quantum dots. The solubility of quantum dots is pegged on these ligand glands.

FUTURE WORK

Future works in the study of ligand molecules will include research on the existence of ligand molecules on the surface of quantum dots. A key difficulty with other methods of analysis has always been distinguishing molecules that are attached to the quantum dots from those that are in the sample but not attached directly to the quantum dots.

REFERENCES

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