

Luminescent Single-Molecule Magnets

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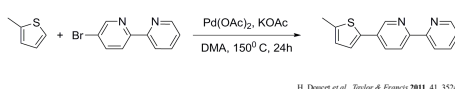
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About me

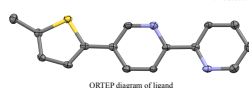
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- Doctorate Student, Tohoku University, Sendai, Japan
- Working on Molecular Magnetism
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- BSc from Midnapore College, Vidyasagar University, Midnapore, India

Synthesis

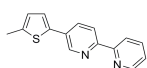
Synthesis of ligand:



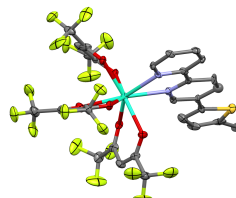
H. Doucet *et al.*, *Taylor & Francis* 2011, 41, 3524



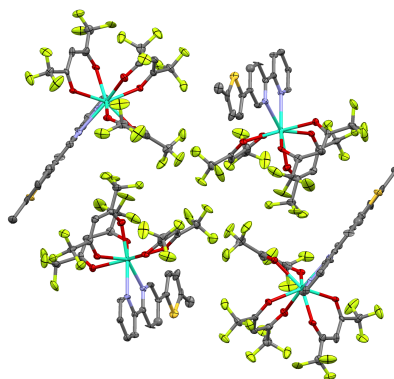
ORTEP diagram of ligand



Complex
 Ln = Dy, Tb or Yb



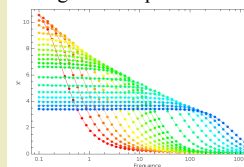
ORTEP diagram of Dy-ion complex



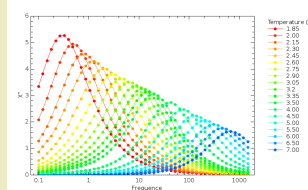
Packing of the complex

Magnetic Properties

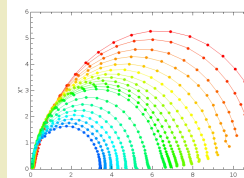
Magnetic Properties of Dy-ion complex



χ' vs. f plot (Magnetic susceptibility showing frequency dependent)



χ'' vs. f plot (Magnetic susceptibility showing frequency dependent)

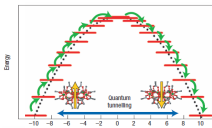


Cole-Cole Plot (χ' vs. χ'' at various temperatures)

Introduction

Single-Molecule Magnets

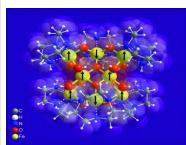
- A single molecule magnet (SMM) is a molecule that shows slow relaxation of the magnetization of purely molecular origin
- It is a molecule that can be magnetized in a magnetic field, and that will retain magnetization even after switching off the magnetic field



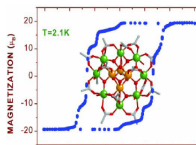
W. Wernsdorfer *et al.*, *Nature Materials* 2008, 7, 189

Criteria for Molecular Magnets

- High magnetic anisotropy (directional dependence).
- High total spin (S).
- No intermolecular interaction.



R. Sessoli *et al.*, *Europhysics News* 2003, 34, 2



R. Sessoli *et al.*, *Nature* 1993, 365, 141

Scope and Objective

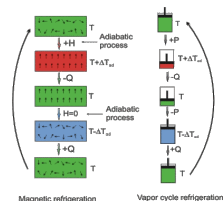
Single-molecule magnet is a new topic in the research field. Some of the possible applications are listed below.

- To increase storage capacity of hard disk.



One possible use of SMMs is to store magnetic bits on hard disks.

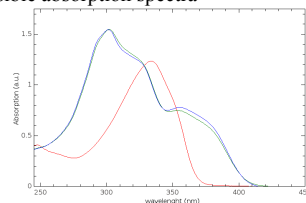
- Magnetic refrigeration.



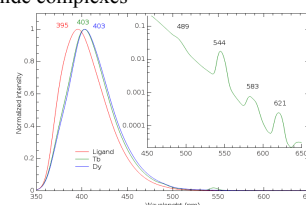
- Quantum computing

Result and Discussion

UV-Visible absorption spectra



Luminescence measurement of ligand and its Lanthanide complexes



Summary/Conclusions

- We have prepared a new lanthanide based single-molecule magnet using thiophene based ligand.
- From the magnetic data, Dy-ion complex shows single-ion magnet behavior.

References

- W. Wernsdorfer *et al.*, *Nature Materials* 2008, 7, 189
- R. Sessoli *et al.*, *Europhysics News* 2003, 34, 2
- R. Sessoli *et al.*, *Nature* 1993, 365, 141
- H. Doucet *et al.*, *Taylor & Francis* 2011, 41, 3524
- Molecular Magnetism book by Oliver Kahn