סמינר מחלקתי – הנדסת חומרים

הנכם מוזמנים בזאת לסמינר מחלקתי
אשר יתקיים ביום ה', 27 במרץ 2025 , כז' באדר תשפ"ה,
בשעה 11:00, בניין 51 באולם 15

Organic Magnetoresistance – a test bed for Dielectric-Spin interactions

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Organic magnetoresistance (OMAR) refers to the change of resistance in an organic material by the application of a magnetic field[1]. It has recently become a 'hot' topic for its ability to show organic spintronics at room temperature and for use as magnetic RAM devices [2], [3]. OMAR materials typically consist of a conducting polymer laced with ferromagnetic particles and sandwiched between electrodes. We demonstrate such a composite made from Poly-pyrrole/ polydimethylsiloxane (PPy/PDMS) matrix.

To investigate this we hark back to an old and largely ignored technique; the linear response to a time domain magnetic pulse. Using a simple home- made time domain impedance spectrometer and a current pulser we demonstrate spin interaction at room temperature in the impedance spectra of the composite. The sample is in series with a passive resistor under a constant voltage of 3V (see the figure 1(b)). A pulsed magnetic field (time duration ~ 1 ms and amplitude approximately 0.2 Tesla) causes an increase in the impedance and the periodic signature of a spin interaction (see figure 1 (a)). The origin of this behaviour can be traced to the polaron conduction mechanism of delocalized π-electrons along the PPy polymer backbone and the spin they carry. A semiclassical theory is presented for the observed behaviour.

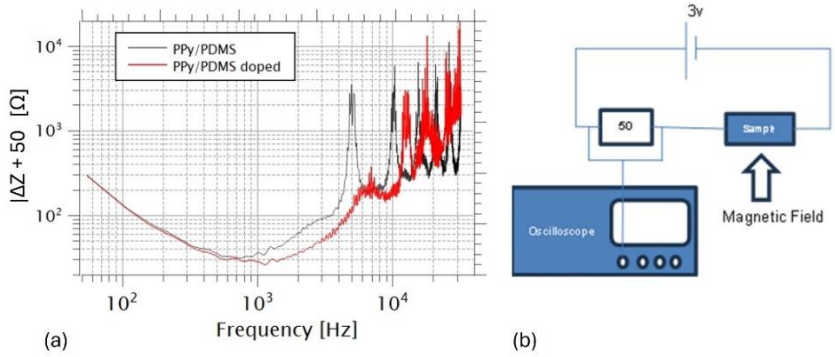

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Figure 1. (a) The impedance spectra of PDMS/PPy layer when exposed to a time varying magnetic field. Periodic oscillations in the spectra point towards spin interaction with the magnetic field. The schematic of the time domain setup (b) used to make the measurements.

References

[1] M. Gobbi and E. Orgiu, "The rise of organic magnetoresistance: materials and challenges," *J. Mater. Chem. C*, vol. 5, no. 23, Art. no. 23, Jun. 2017, doi: 10.1039/C6TC04403D.

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[3] R. Wirecka, K. Maćkosz, A. Żywczak, M. M. Marzec, S. Zapotoczny, and A. Bernasik, "Magnetoresistive Properties of Nanocomposites Based on Ferrite Nanoparticles and Polythiophene," *Nanomaterials*, vol. 13, no. 5, Art. no. 5, Jan. 2023, doi: 10.3390/nano13050879.

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