Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Giant Spin Pumping at Ferromagnet (Permalloy) - Organic Semiconductor (Perylene diimide) Interface

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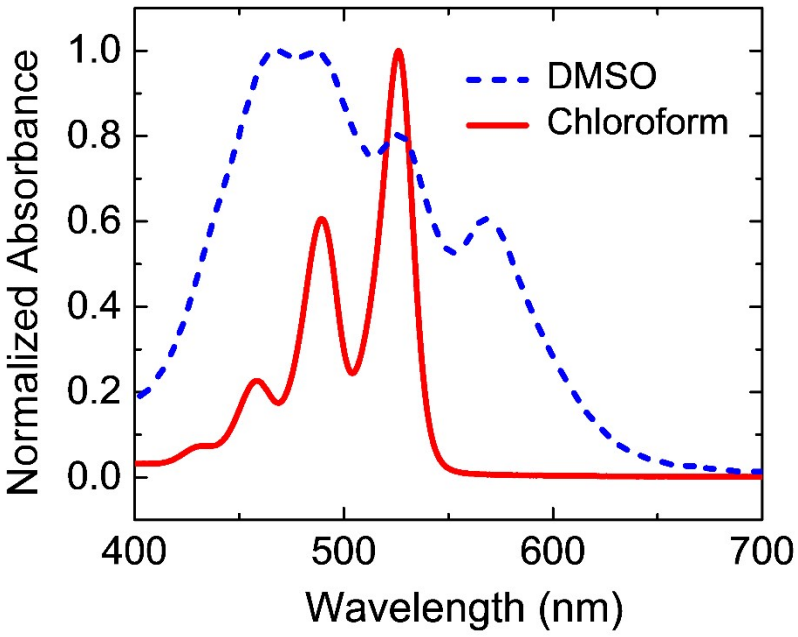

Fig. S1 Normalized UV-Vis absorption spectra of PDI in chloroform and DMSO at 0.125 mg/mL.

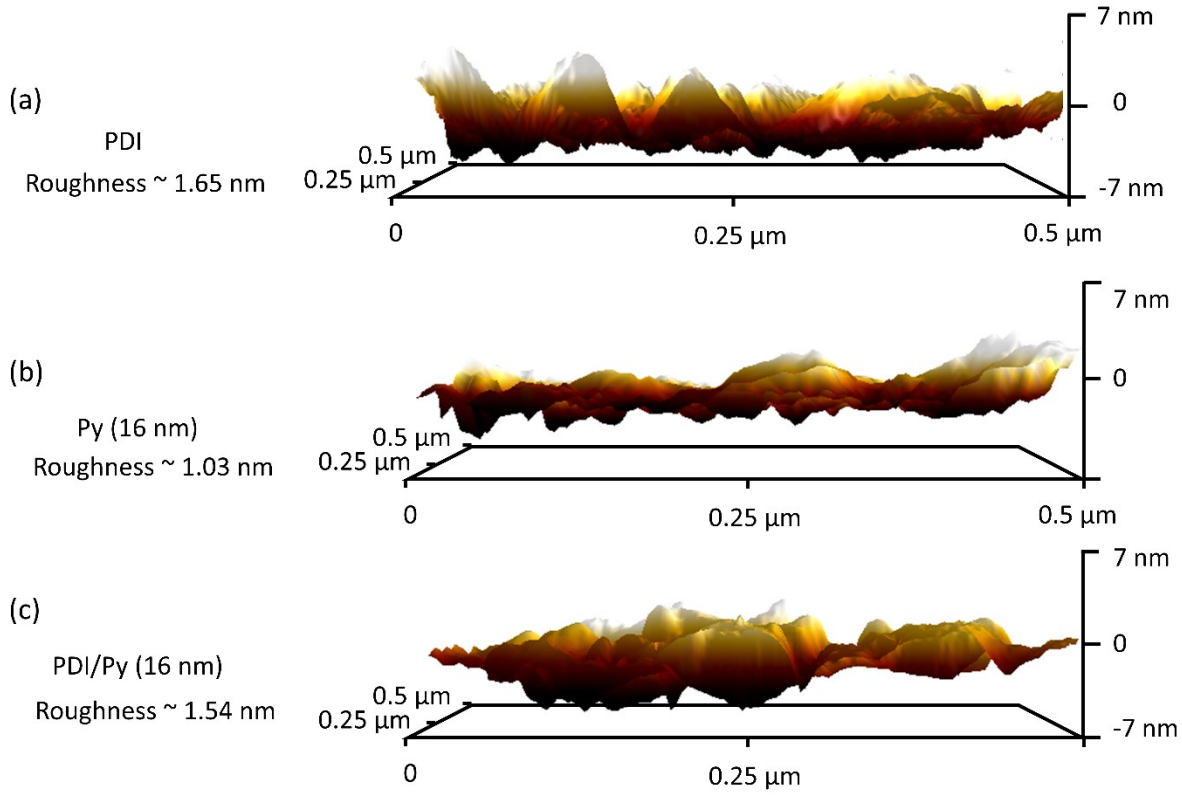

Fig. S2 AFM roughness profiles of (a) PDI, (b) Py (16 nm) and (c) PDI/Py (16 nm) deposited on Si substrate.

AFM profiles of bare PDI in Fig. S1(a) show rod-like structures which can be understood as stacks of PDI molecules due to J-aggregation. And the roughness of PDI layer on Si is observed to be 1.655 nm. Fig. S1(b) shows the roughness profile of bare Py deposited on Si and the roughness is estimated to be 1.03 nm. Fig. S1(c) shows the roughness of PDI/Py film and the roughness is around 1.54 nm. Since spin pumping is an interfacial phenomenon; the roughness of the bottom layer plays a significant role in the linewidth broadening. Here we have found that the roughness of the bare individual films and the PDI/Py film are very similar.

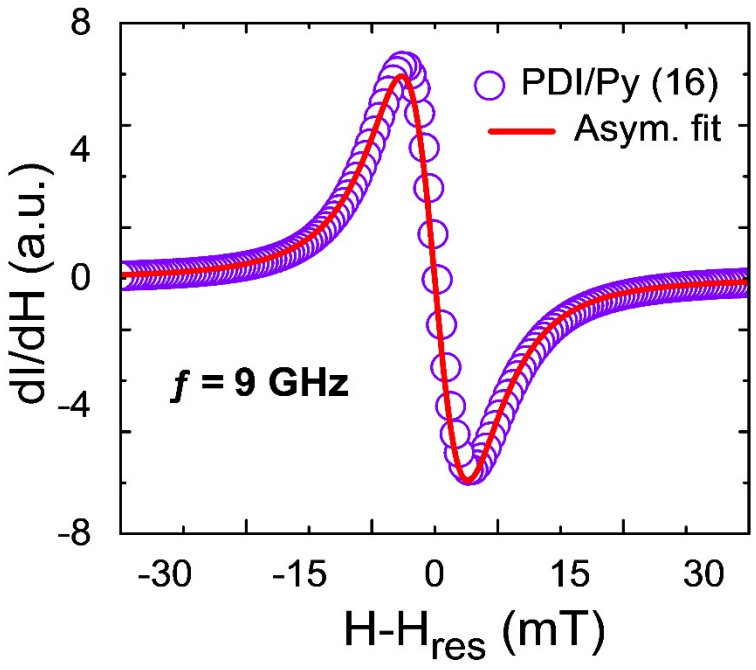

Fig. S3 Derivative of the FMR absorption spectrum along with an asymmetric Lorentzian fit for PDI/Py(16) sample at 9 GHz.

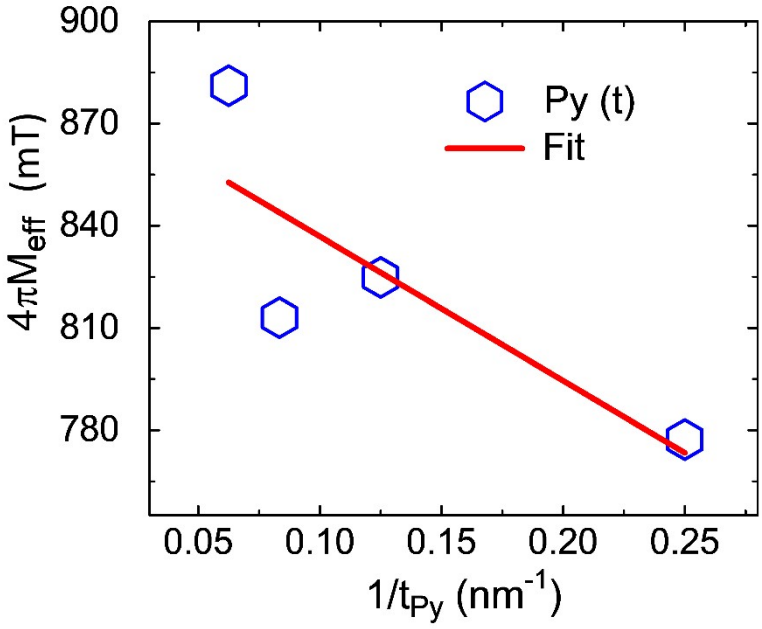

Fig. S4 Fit to find M_s from the thickness dependence of effective magnetization of PDI/Py (t)

The saturation magnetization (M_S) for a continuous film is given by

$$4\pi M_{eff} = 4\pi M_S + \frac{2K_S}{M_S t_{FM}}$$

where, K_S is the perpendicular surface magnetic anisotropy constant, $4\pi M_S$ is saturation magnetization and t_{FM} represents the thickness of the Py (FM). Fig. S4 shows the plot between $4\pi M_{eff}$ vs $1/t_{py}$. It can be observed that the effective magnetization is increased with an increase in Py thickness. Saturation magnetization was obtained by fitting the data to the above equation.

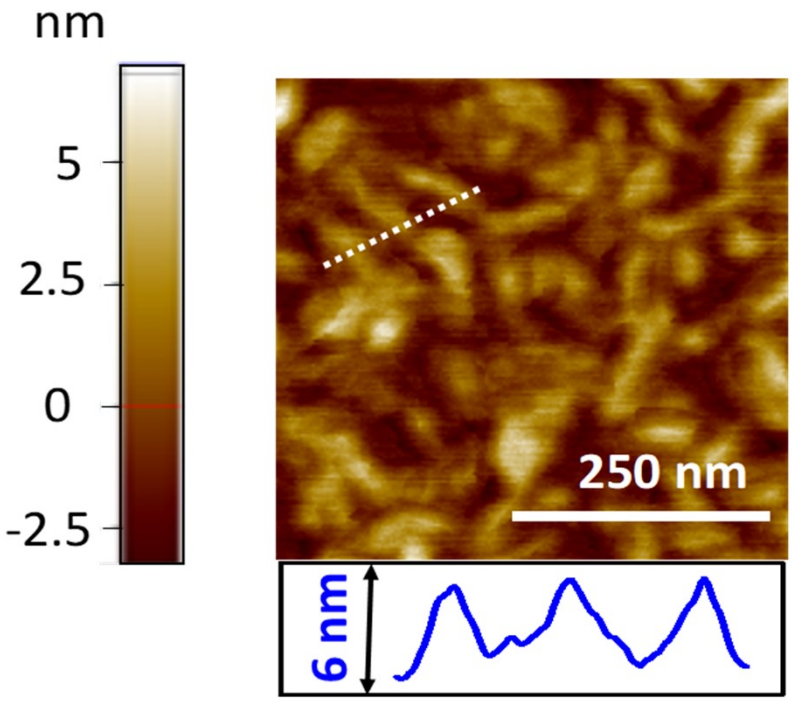

Fig. S5 AFM topography image showing height of PDI J-aggregates