Time resolved fluorescence characterization of oligo(*p*-phenylene ethynylene) based metallic nanorods.

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Highly conjugated molecules are being investigated for their potential applications in nanoelectronics [1] and in optoelectronics [2]. These systems are characterized by a delocalized π-electronic density which could provide a pathway through which the movement of electrons is facilitated and, therefore, they could act as a model for molecular wires. Moreover, the excited π-electronic density can relax radiatively by emission of a photon in a typical fluorescent process. In particular, organometallic nanorods with robust and redox capable metal centers can offer excellent properties over their organic counterparts by increasing energy throughput. However the determination of the electrical conductivity at the molecular level requires skilled sample preparation and sophisticated equipment. On the other hand, time resolved fluorescence is a powerful technique that provides valuable information about the dynamic processes involved in the relaxation of the excited π-electronic states.

In this study we analyze the fluorescence emission decays of different Metal-Ligand-Metal where L are oligo(*p*-phenyleneethynylene)s (OPE) and M are the metal complex moieties $PdCl(PEt_3)_2$ and $RuCl(dppe)_2$. We have observed a significant reduction of the emission decay in the organometallic nanorods as compared to the Ligand OPE molecule without metallic termination complexes (example in Fig. 1). This result has been interpreted as an indication of a charge transfer process from the π-electrons to the metal complexes that can advantageously be used to improve the electrical conductivity of the nanorods. These results show the potential of the Time Resolved Fluorescence technique as a first test to select the best molecules for nanoelectronic applications. In addition to this, two of the obtained crystal structures (example in Fig. 2) will be presented.

References

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Figures

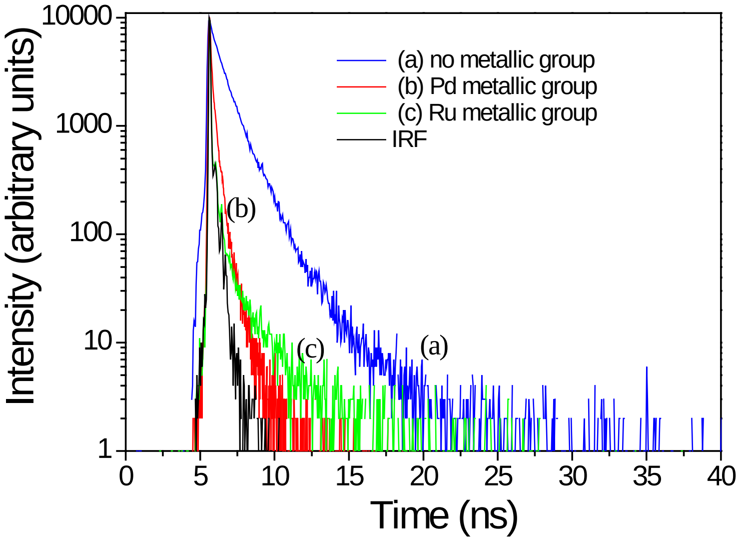

Figure 1: Fluorescence decay curves of a OPE nanowire (a) without termination group; (b) with Pd metal complex (Pd metallic termination group); and (c) with Ru metal complex (Ru metallic termination group). Instrumental response function (IRF) of the equipment is also included.

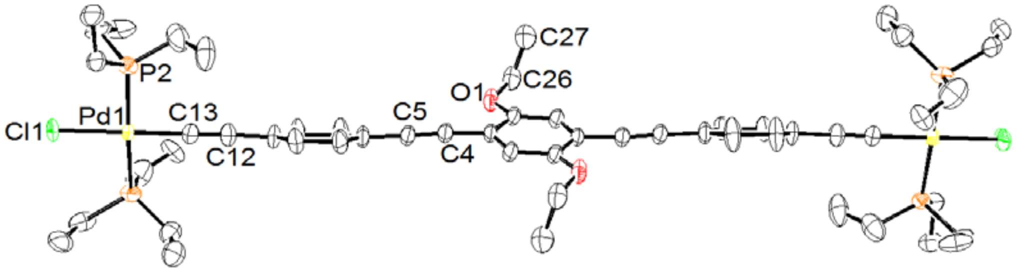

Figure 2: Plot of a $PdCl(PEt_3)_2$ tris(phenylene ethynylene) rod (50% probability displacement ellipsoids).

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