Understanding Charge Transport in Organic Field Effect Transistors

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The organic electronics research field has advanced tremendously in the last decades, having already led to field-effect mobilities able to compete with their inorganic counterparts.[1-4] However, many fundamental aspects of this field remain still unclear and need to be clarified before its final blossoming, which would probably come with the complete understanding of the charge transport mechanism in organic materials.
It is well-known that the performance of organic semiconductors is governed not only by their molecular structures but also by their intermolecular assembly in the solid state.[5] Therefore, analyzing organic materials from both a molecular and supramolecular point of view is highly desirable. For this end, Raman spectroscopy is a rapid, non invasive technique able to gather information on molecular and supramolecular levels, thus being greatly useful in the organic electronics research field.[6,7]
Analyzing buried interfaces, such as the semiconductor-dielectric interface in organic field effect transistors (OFETs) is fundamental, since the largest contribution to charge transport occurs within the first few nanometers of the semiconductor near the dielectric interface. Surface Enhanced Raman Spectroscopy (SERS) appears as an easy and straightforward technique to carry out this task and to provide useful information on molecular orientation at the device active layer.[8,9]
In this communication, some examples will be presented in which several spectroscopic techniques, conventional Raman and SERS, supported by DFT quantum chemical calculations have been used to shed light on the mechanism of charge transport in OFETs.[10,11]

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