UNDERSTANDING CONDUCTANCE HISTOGRAMS OF SINGLE MOLECULAR JUNCTIONS

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When a single molecular junction is formed, there is a large range of possible detailed atomic configurations that can be realized. In order to extract significant values for the electrical properties of a characteristic molecule, a statistical analysis is required over many junctions realizations. In the literature, different results for molecular junctions based on simple molecules such as alkanethiols have been reported [1-5]. In this work, we establish that differences in the statistical treatment are not the cause of these discrepancies [6]. A mechanically controllable break junction technique has been used to explore the conductance of single molecular junctions based on octanedithiols, oligo(phenylene elthynylene)s and oligo(phenylene vinylene)s. All the experiments have been carried out at room temperature and in liquid environment. We perform different data treatments to collections of conductance traces recorded during ~100 breaking processes for several junctions. The variations in the conductance histograms due to these treatments are then described. In addition, we show that the histogram of the logarithmic of the conductance is the best representation to spot the molecule bridge contribution out of the Au-Au tunnelling background (see figure 1). The method shows to be suitable to distinguish between oligo(phenylene elthynylene)- and oligo(phenylene vinylene)-junctions by their electrical transport properties.

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Figures:

Figure 1: Histogram of the logarithmic of the conductance built from approximately 100 conductance vs. displacement curves in pure mesitylene (grey) and in solution 1mM octanedithiol (red). The arrows indicate the conductance peaks that appear when octanedithiol is added. The tunnelling contribution to the histogram is a constant background (indicated by blue and dashed-black lines for pure mesitylene and octanedithiol respectively).