Magnetoresistance in Au/1,6-hexanedithiol/Au junctions at room temperature

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Magnetoresistance (MR) effects observed for organic thin film devices with non-ferromagnetic electrodes, called organic magneto-resistance (OMAR), widely unfolds new interesting behaviors [1]. Lately, Xie et al. reported that resistance of self-assembled monolayers of oligophenylene-thiol-molecules with Au electrodes becomes large under the magnetic fields, i.e., positive MR effect, based on the conductive atomic force microscope measurement at 0 T and 0.1T [2]. They explained that this OMAR effect in organic molecular tunneling junctions originated from the triplet states formed by a tunneling hole and an unpaired hole in the π-orbital generated due to energy level alignment between the molecule and electrode. The origin of the OMAR at molecular tunnel junctions is still under debate.

In this study, we investigated the MR effects in Au/1,6-hexanedithiol (HDT) /Au junctions at room temperature. We performed the measurements using a mechanically controllable break junction (MCBJ) method [3] under Ar atmosphere (Fig. 1). The DC bias voltage of 30 mV was applied during the breaking process. When the conductance reached below 1 G_0 ($G_0 = 2e^2/h$) at which gold atomic junction is formed, the magnetic field was swept at rate 40 mT/s up to ±95 mT. Figure 2 shows the result. Gradual increase of resistance against the magnetic field, i.e., positive MR, was observed. Because the π-orbital is not involved in the junction, we consider the observed MR effect might be originated through magnetism induced via gold atom-thiols interaction [4,5,6] at the interface.

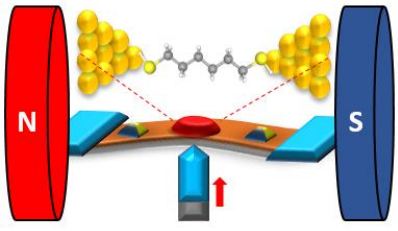

Figure 1. Set-up for MCBJ measurements under magnetic field.

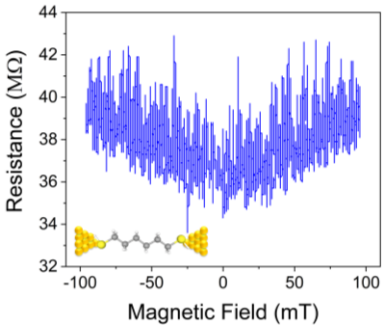

Figure 2. MR curve of an Au/HDT/Au junction

Reference
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