Exploring charge transport properties and functionality of molecule-nanoparticle ensembles

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Propositions

accompanying the dissertation

"Exploring charge transport properties and functionality of molecule-nanoparticle ensembles"

1. Independent optical experiments are key for a proper interpretation of charge transport data in molecule-gold-nanoparticle devices.
   Chapter 3-6 of this thesis

2. The on-off ratio of a switchable molecule-gold-nanoparticle device can be artificially enhanced by entering the multiple inelastic cotunneling regime.
   Chapter 4 of this thesis

3. In contrast to bulk spin-transition materials, cooperativity in spin-transition-molecule-nanoparticle networks is negligible.
   Chapter 1 and 6 of this thesis

4. Percolation plays a key role in spin switching of spin-crossover-molecule-gold-nanoparticle ensembles.
   Chapter 6 of this thesis

5. Efros-Shklovsii transport as observed by Moreira *et al* actually forms a subregime of the multiple inelastic cotunneling transport regime.
   H. Moreira, Q. Yu, B. Nadal, B. Bresson, M. Rosticher, N. Lequeux, A. Zimmers and H. Aubin, "Electron Cotunneling Transport in Gold Nanocrystal Arrays", Phys. Rev. Lett. **107**, 176803 (2011).

6. While Zotti *et al* focus on the relation between the type of anchor group and the position of the molecular energy levels in a single-molecular junction, this concept needs to be extended to include the relation between the anchor group and the mechanical stability of such a junction.
   L. A. Zotti, T. Kirchner, J.-C. Cuevas, F. Pauly, T. Huhn, E. Scheer, A. Erbe, "Revealing the Role of Anchoring Groups in the Electrical Conduction Through Single-Molecule Junctions", Small **6**, 1529 (2010).

7. In contrast to common practice in literature, intermolecular interactions are always to be considered in charge transport experiments through molecular junctions. This matter is for instance ignored in Chen *et al*.
   F. Chen, J. Hihath, Z. Huang, X. Li, N. J. Tao, "Measurement of Single-Molecule Conductance", Annu. Rev. Phys. Chem. **58**, 535 (2007).

8. To understand and exploit the wealth of self-assembly processes in nanotechnology, one should not only be a chemist, but also a physicist and a biologist. This point is underestimated in Whitesides *et al.*
   G. M. Whitesides and B. Grzybowsky, "Self-Assembly at All Scales", Science **295**, 2418 (2002).

9. An international research project broadens one's scope scientifically, professionally and culturally.

10. To explore new scientific grounds, development of dedicated experimental equipment is key.

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