

Organic Electronic Materials 2025 Exercise 7 (submit on 25.05.25)

1. Which term of the one-electron Hamiltonian for charge transport has to dominate for band transport in organic materials? Justify this answer by explaining what is happening when this term dominates to both the energy levels of each energy site of the system and the electrons.
2. 'Hopping' is one of the main incoherent charge transport mechanisms in organic semiconductors. Justify this terminology by briefly explaining how it works with the help of an energy state diagram. Include in your explanation how the temperature is related to the mechanism.
3. Why do the transfer steps in disorder-controlled charge transport become asymmetric?
4. How does charge transport occur in the "multiple trap and release" (MTR) model? Describe the two competing (in fact, opposing) effects of the temperature on mobility according to this model.
5. According to the research presented in Chapter 6.5, what are the two characteristic parameters of an organic semiconductor that determine the energy landscape and the charge transport mechanism inside of it?
6. How can one determine experimentally if the dominant charge transport regime in an organic semiconductor is coherent or incoherent?