

Molecular-Level Devices and Machines

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The chemical, bottom up approach, based on the concepts of supramolecular chemistry, can be very useful to design and construct interesting nanostructures.

By using this approach, the macroscopic concepts of a device and a machine can indeed be straightforwardly extended to the molecular level [1]. A *molecular-level* device can be defined as an assembly of a discrete number of molecular components designed to achieve a specific function. Each molecular component performs a single act, while the entire assembly performs a more complex function, which results from the cooperation of the various molecular components. A *molecular-level machine* is a particular type of molecular-level device in which the component parts can display changes in their relative positions as a result of some external stimulus.

Molecular-level devices and machines operate via electronic and/or nuclear rearrangements and, like macroscopic devices and machines, are characterized by (i) the kind of energy input supplied to make them work, (ii) the way in which their operation can be monitored, (iii) the possibility to repeat the operation at will (cyclic process), (iv) the time scale needed to complete a cycle, and (v) the performed function. In this lecture, we will illustrate examples of recent achievements in this field.

[1] Balzani V., Credi A., Venturi M., *Molecular Devices and Machines - A Journey in the Nano World*, Wiley-VCH, 2003.

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