# Chapter 2. Introduction

* Self-assembly: reversibility introduces the stability
* Preorganization: willing to form a certain structure as pre-designed to promote the complexation, by using the enthalpy and entropy. Example: Stability of Rosettes
* Hydrogen bonding: the strength can be tuned, the hydrogen energy, secondary interactions and effect of preorganization.
* Metal-ligand interactions: kinetics and thermodynamics products. Play with the energy barrier of chemical reaction.
* Pi-pi interaction: example interlocked cage
* hydrophobic effect: entropy gain of the water from freed solvation
* Design of a guest.

# Chapter 3. Self-assembly

* Number of particles related to the chemical potential. To find a sweet point to make the nanotube, we find the lowest chemical potential point to make the hollow tube structure. The Carbon length is between 8-12.
* Supramolecular stacks from disc-like building blocks. Identify the charity by circular dichroism.
* Pi-conjugation bandgap…
* Example by pi-pi stacking and hydrogen bonds: 1. Supramolecular electronics: electronic trap 2. Supramolecular polymers: controlling the degree of polymerization, hydrogen bonds in affecting the association constant 3. Non-infinite aggregates.

# Chapter 4. Self-assembly in water

* Physical properties of solutions of amphiphiles are strongly concentration dependent. Diffusion coefficient, solubility, surface tension and conductance.
* Water plays a role in driving micelle formation: take an example of put argon into the water, formation of water shell around solute is very unfavorable from an entropy point to view.
* Vesicles, shape and some special applications.

# Chapter 5. Self-assembly and stabilization

* Because of the reversibility, consider about the stabilization.
* The polymerization will have effect on the phase transition by UV or synthetic surfactant.
* The Dendritic structure leads to convergent synthesis.

# Chapter 6: self-assembly for larger building blocks

* Make use of capillary force for self-assembly to minimize the interfacial free energy.
* Hydrophobic side part drives the two objectives to connect.

# Chapter 7: liquid crystal

* Thermotropic LCs exhibit a phase transition into the LC phase as temperature is changed.
* Lyotropic LCs exhibit phase transitions as a function of concentration. As the concentration increases, the assemblies become ordered.
* Onsager hard-rod model at large densities it might be more a favorable for the molecules to align spontaneously, since the resulting loss of orientational entropy is by far compensated by the gain of translational entropy.
* Complex structure: polymer liquid crystals are a class of materials that combine the properties of polymers with those liquid crystals. Also, virus show some properties relate to the LC.
* Application: LED, photovoltaic.
* Manufacturing LCD: make the LC anchoring to the surface

# Chapter 8: Biomimetic mineralization/synthesis

* Biomineralization exhibit a high level of spatial control as the mineralization usually takes place in a confined reaction environment.
* Polymorphs of CaCO3: thermodynamic crystal growth, kinetic crystal growth, additive (like template, blocking certain surface),
* Using of template: 2D layers and make use of surfactant.

# Chapter 9: Nanomotors

* Motor to rotate by hydrolysis the ATP continuously.
* Trans and cis conformation of the catalyst with the rotaxane motor.

# Chapter 10: Scanning probe microscopy

* STM principle: tunneling current.
* Two modes: constant height mode and constant current mode.
* AFM principle: sensing the force while the tip across the surface.
* Based on the attractive by the atoms on the surface. First from the attractive regime and then the repulsive regime.
* DC and AC modes.
* Other force realized by the surface.

# Chapter 11: Langmuir and Blodgett

* Surface tension and surface energy in the solution.
* Surfactants’ association behavior in solution.
* Thermodynamics in the interface: interfacial excess.
* The barrier of the surfactants, described by the film pressure. This would drift in the direction of the liquid with higher surface tension.
* Film transfer and a few applications examples.

# Chapter 13: Self-assembled Monolayers

* The energy of the self-assembled monolayer and its structure based on the LB films.
* The difference of chemisorption and physisorption from distance point of view.
* Vdw interaction of alky chains make difference on tilts.
* Effect of the symmetry make difference on the interactions.
* Contact angle: wettability based on the end group.
* Post-self-assembly, do the pattern by different technique.
* Mixture of SAM A and B
* Some applications based on the self-assembled monolayers.