



HAL
open science

Thermoresponsive polymers and host-guest chemistry: a win-win combination

Patrice Woisel

► **To cite this version:**

Patrice Woisel. Thermoresponsive polymers and host-guest chemistry: a win-win combination. Scientific day ICP/A2U-Chemistry “Supramolecular Chemistry”, Dec 2023, Amiens, France. hal-04356190

HAL Id: hal-04356190

<https://hal.univ-lille.fr/hal-04356190>

Submitted on 20 Dec 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Thermoresponsive polymers and host-guest chemistry: a win-win combination

Patrice Woisel

^a Univ. Lille, CNRS, Centrale Lille, INRAE, UMR 8207 - UMET - Unité Matériaux Et Transformations

Keywords: Thermoresponsive polymers, Host-guest complexation, memory function, synergistic control of host reactivity

Abstract:

The combination of heat-sensitive polymers and supramolecular chemistry has recently led to the development of fascinating adaptive materials. In this context, most studies have focused on exploiting host-guest interactions to control the physicochemical properties of polymeric materials.¹ This approach has notably enabled the creation of materials with programmable thermosensitivity and sensor properties.² In contrast, the exploitation of polymer thermoresponsiveness to control the recognition properties of host-guest systems at the molecular level is much less developed, and a perfect understanding of the mechanisms triggering thermo-induced decomplexation or complexation is still elusive.

In this communication, we will illustrate through three studies how the host-guest chemistry and the thermo-induced phase separation mechanisms can “talk together” to synergistically tune the coil↔globule transition and the complexation state of polymeric systems. The first example³ will concern a comparative analysis of the behaviour of complexes formed from different naphthalene end-functionalized LCST or UCST polymers and the electron-deficient cyclobis(paraquat-p-phenylene) tetrachloride (**CBPQT⁴⁺**, **4Cl⁻**)³ host when subjected to heat treatment. This study provided an understanding of the mechanisms triggering the thermo-induced (de)complexation of such complexes. The second study will report a supramolecular approach for developing an intelligent thermoresponsive polymeric hydrogel featuring a dual temperature and time memory function based on a kinetic control of the material's (de)complexation and (re) swelling behaviours. The last study will illustrate how a thermo-induced phase separation mechanism can regulate on demand the Diels-alder reactivity of a synthetic self-complexing host-guest molecular switch **CBPQT⁴⁺-Fu**, consisting of an electron-rich furan unit covalently attached to the electron-deficient **CBPQT⁴⁺** host, with maleimide in water. Thanks to a supramolecular

control over the topology of **CBPQT⁴⁺-Fu** combined with a thermoresponsive supramolecular regulator, we reported a rare example of decreased reactivity upon increasing temperature.

References :

- 1) V. R. de la Rosa and coll., Mater. Today, 2016, 19, 44-55; 2) N. Herzer and coll. J. Am. Chem. Soc. 2012, 134, 7608–7611; 3) H. Guo and coll. Polym. Chem. 2022, 13;25, 3742-3749, 4) P. R. Ashton and coll. Angew. Chem., 1988, 27, 1550-1553; 5) L. De Smet and coll. ACS Materials Letters, 2022,5;1, 235-242; 6) C. Ribeiro and coll. submitted

