The more the merrier: thicker pore walls to increase stability

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INTRODUCTION

The discovery of ordered mesoporous silica's was a revolution in materials science, both from a preparative point of view, and for their applications. However, when high temperature working conditions are required, its amorphous nature and thin pore walls are not advantageous, which leads in most cases to the mesostructure collapse. To increase its robustness, we must favor the degree of growth and condensation of the inorganic counterpart. Here, we use Si-atrane complexes as silica hydrolytic precursors and CTAB as primary surfactant template, but we add a second surfactant such as F127 in order to improve the mesopore wall thickness.

OBJECTIVES

To control the growth of the NPs

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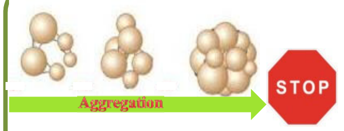

To limit the aggregation level

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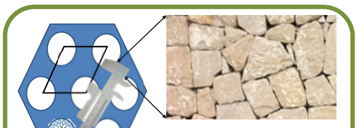
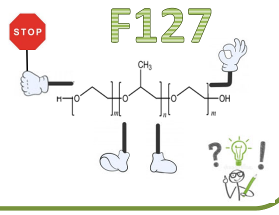
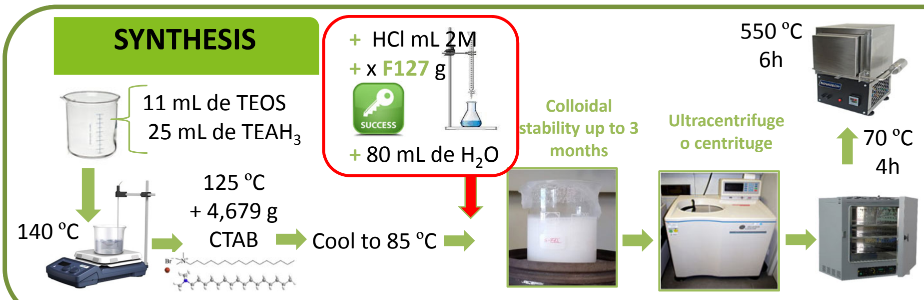


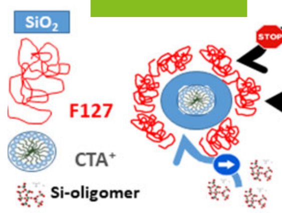
To increase the pore wall thickness



SYNTHESIS



STRATEGY

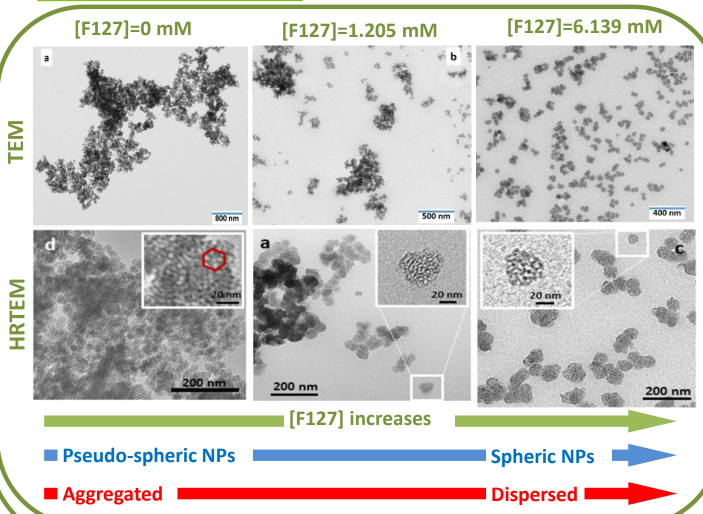


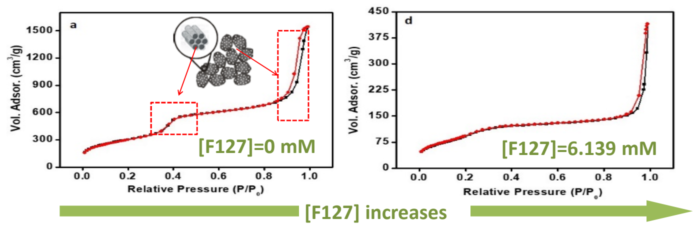
CTAB → micelles → mesopores

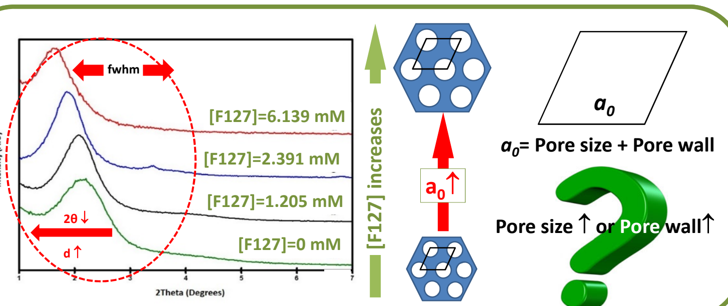
F127 → act as a "membrane" :

- Hinders the access of CTAB
- Allows the access of the Si oligomers

RESULTS







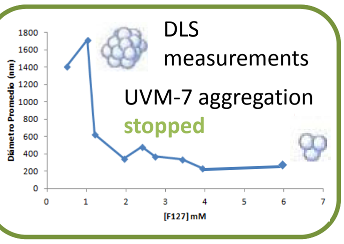
CONCLUSIONS

mesopore↓ when ↑[F127]
↓ micelles compaction

macropore↓ when ↑[F127]
↓ aggregatión

[F127] ↑ mainly affects the pore wall

[F127] mM	d 100 (Å)	a_0 (Å)	S_{BET} (m^2/g)	BJH $_{meso}$ (Å)	BJH $_{macro}$ (Å)	Mesopore volume (cm^3/g)	Macropore volume (cm^3/g)	Mesopore wall thickness (Å)
0	41,1	47,6	1105,65	27,54	437,32	0,86	1,35	20,06
1,205	42,57	49,16	578,48	24,1	590	0,38	0,55	25,06
2,45	47,18	54,48	358,37	22,18	753	0,15	0,42	32,3
6,2	53,8	62,12	337,1	26,75	525,2	0,28	0,41	35,37



DLS measurements

UVM-7 aggregation stopped

Increase colloidal stability an ↑[F127]

Size decreases