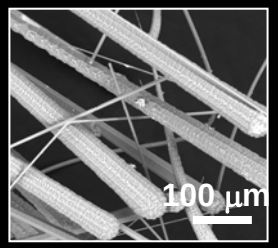
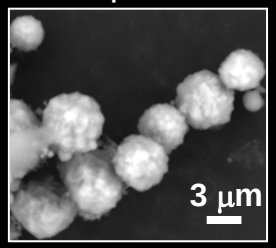
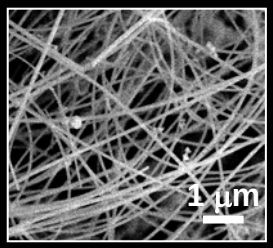
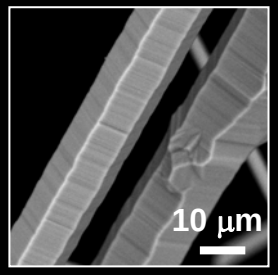
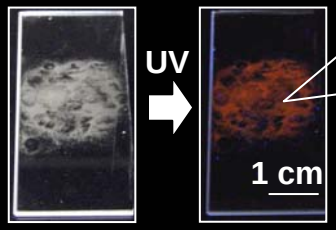
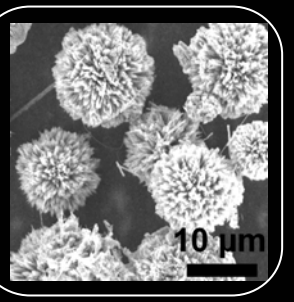
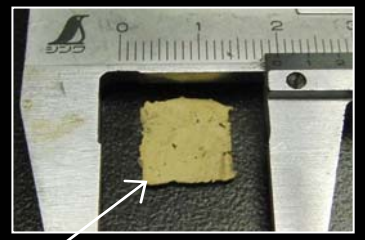
$SiCl_4 + 2Zn \rightarrow Si + 2ZnCl_2$

Condition1 | Condition2 | Condition3

	Needle-like	Microparticles	Nanowires
SEM images			
	↓enlargement	↓etching	
Characteristics		 	・Diameter < 100 nm ・Rough surface of nanowires
	・Single crystal ・High purity > 99.9999%	・Orange-red photoluminescence under UV light	・Drastic change in morphology →“echinus-like”
			 Fabric of nanowires
Application	Solar cells (photovoltaics)	・Chemical sensor ・Bio-imaging material	・Silicon anode for Lithium-ion batteries
			・Thermoelectric material

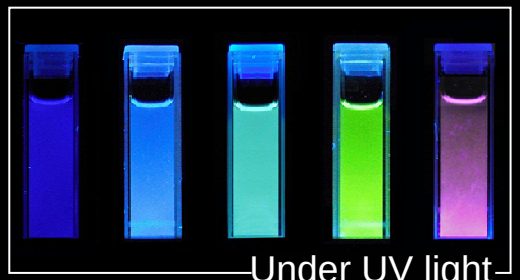
Various Silicon Materials via the same reaction

Our recent interest : How to selectively produce them?

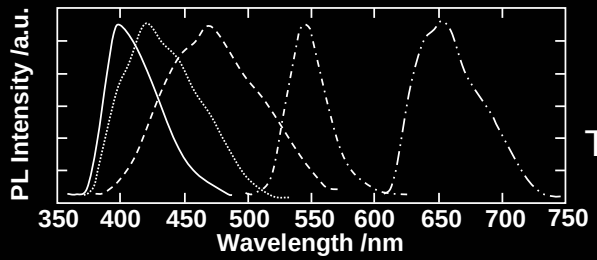
Si nanoparticles
by plasma decomposition of $SiBr_4$ or $SiCl_4$

Characteristics

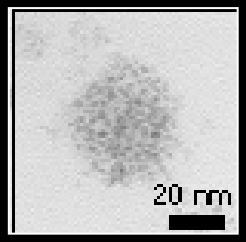
Multi-color photoluminescence(PL)
(dispersed in ethanol)



Under UV light

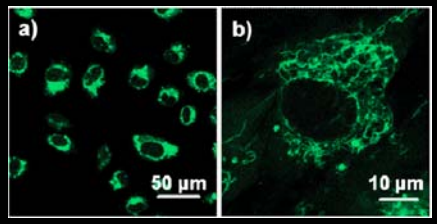


PL Spectra of the above samples



TEM image of an “aggregate”
of Si-nanoparticles

Application
as a bio-imaging material



Fluorescent images
of live cells labeled with Si-nanoparticles.
(Human umbilical vein endotherial cells)

・Good stability in PL intensity
・Possibility as a new bio-imaging material

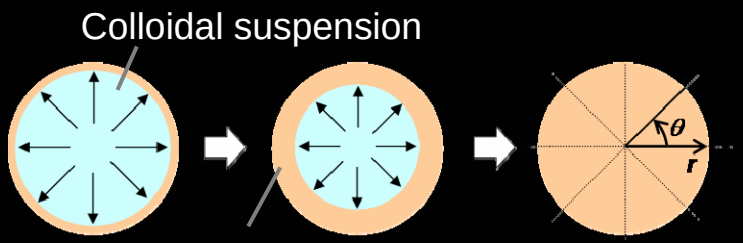
However, production rate is still small so far…..
Our recent interest : How to scale up production rate?

Film formation kinetics during drying of a suspension

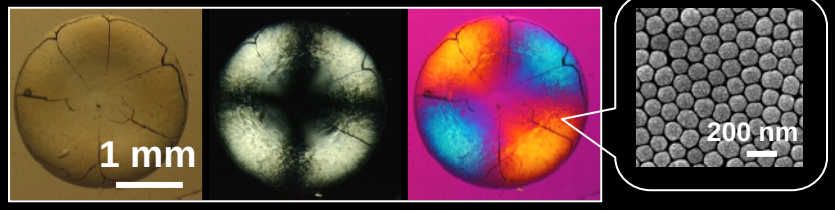
How films and “defects” in films form during drying?

Distortion in film structure due to drying

Colloidal film formation by drop drying method

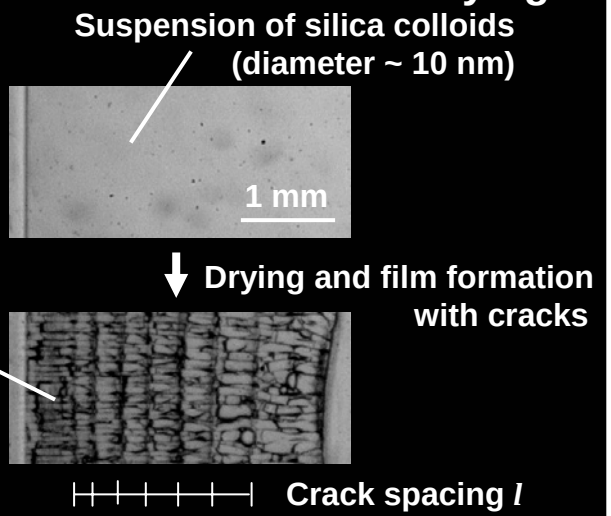


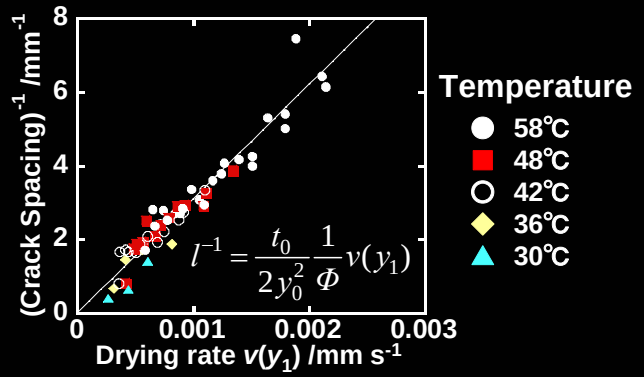
Birefringent film of spherical colloidal particles



Normal light + crossed polarizers + compensator

Crack formation in films due to drying





Not drying temperature, but drying rate is a dominant factor for crack spacing.