# Controlling the Assembly of Silver Nanocubes through Selective Functionalization of Their Faces

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### COMMUNICATION

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**Controlled Assembly of Silver Nanocubes** 

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## **Introduction**

Self-assembly provides an effective route to well-defined structures that are close to or at a thermodynamic equilibrium state.

The structures commonly observed are closely packed lattices due to an isotropic interaction between the

building blocks

Five distinct SAM-modified Ag nanocubes



Assemble them into four different nanostructures and one microstructure using hydrophobic and hydrophilic interactions.





A) Nnanocubes are dropcasted onto a Si substrate and dried.

- B) It is immersed in a mercaptohexadecanoic acid (MHA) ethanolic solution for 1 h, removed and washed with ethanol. 5 faces get functionalized.
- C) It is immersed in an octadecanethiol (ODT) ethanolic solution and is sonicated. The nanocubes detach from the substrate and the protected face is now functionalized with ODT.
- D) From step-A, the substrate is printed with a PDMS stamp inked with ODT in ethanol, and then thoroughly washed with ethanol. This step functionalizes only the top face of the Ag nanocube.
- E) It is immersed in a MHA ethanolic solution for 1 h, removed and washed with ethanol. 4 faces get functionalized. Followed step-C.

# SEM images of Ag nanocubes and the assemblies.







A) Sonication assists the Ag nanocubes to the water surfaceB) The hydrophobic Ag nanocubes are attracted to the airwater interface

C) The Ag nanocubes then self-assemble face-to-face at the interface to form a two-dimensional sheet

D)More Ag nanocubes are added to the existing structure from the water side, pushing the entire structure upward.

# <u>Conclusions</u>

Ag nanocubes have been assembled into different structures by selective functionalizations of faces. Assembly was aided by hydrophobic/hydrophilic forces. • The procedure is limited only by the Ag nanocubes available and the size of the Si substrate. Study suggests that the hydrophobic force can be controlled to make novel self-assembled nanostructures through anisotropic interactions in solution and at the air-water interface.

Can be scaled up to generate large quantities of selfassembled structures for use in surface-enhanced Raman scattering (SERS) applications.











