

# SYNTHESIS OF JANUS PARTICLE WITH GOLD NANO PARTICLES AND VESICLE-LIKE MESOPOROUS SILICA

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## Research Motivation

Merging the fields of photonics and bio-nanotechnology have become major areas of research due to their numerous applications in the health care. The ability to detect biomarkers for cancer, heart diseases and infections agents presents one of the major driving force for the development of these areas. Although lots of mechanisms have been introduced over the years, there are still some limitations on the materials development, and this research seeks to find solutions to these limitations.

## Introduction

- A Janus particle is a special type of nano/micro particle whose surface has two or more distinct physical and chemical properties.
- Vesicle-like mesoporous silica have distinctive geometries that are expected to display novel characteristics for the development of new technologies in the field of bio-nanotechnology
- Gold nanoparticles which are small gold particles with diameter ranging from 1 to 100 nm has been used in biosensing applications over the years but limited to accuracy, damage to non-targeted tissues and invasive needle placements.
- The aim of this research is to fuse the vesicle-like mesoporous silica and gold nanoparticles to form a Janus particle to improve the application of bio-nanotechnology and photonics.

## Research Method

The research involved two stages. The first stage was the synthesis of the vesicle like mesoporous silica and gold nano particles and the second stage was the fusion of the synthesized materials to form the Janus particle

- Synthesis of Vesicle-like mesoporous silica: A solution of 2.0 g P123, 65 ml H<sub>2</sub>O and 10 ml HCl was prepared and stirred for 24 hours at a temperature of 35°C . A ratio of 34.8 TIPB : 1 PI23 solution was added dropwise to the mixture under stirring and 2.1 g of TEOS was further added to the solution. Solution as heated at 130°C, filtered and calcined at 500°C.



Figure 1: Experimental setup of vesicle-like mesoporous silica

- Synthesis of Gold nanoparticles: 10 ml of a 0.3 mM HAuCl<sub>4</sub>·3H<sub>2</sub>O was heated to boiling under stirring and 5 ml of a 39 mM was added dropwise, and solution was allowed to react for 10 mins and cooled to room temperature.



Figure 2: Experimental setup of colloidal nanoparticles

- Structural Characterization: Synthesized samples were prepared for Scanning Electron Microscopy and Transmission Electron Microscopy to determine the morphology of the samples for further work.

## Results

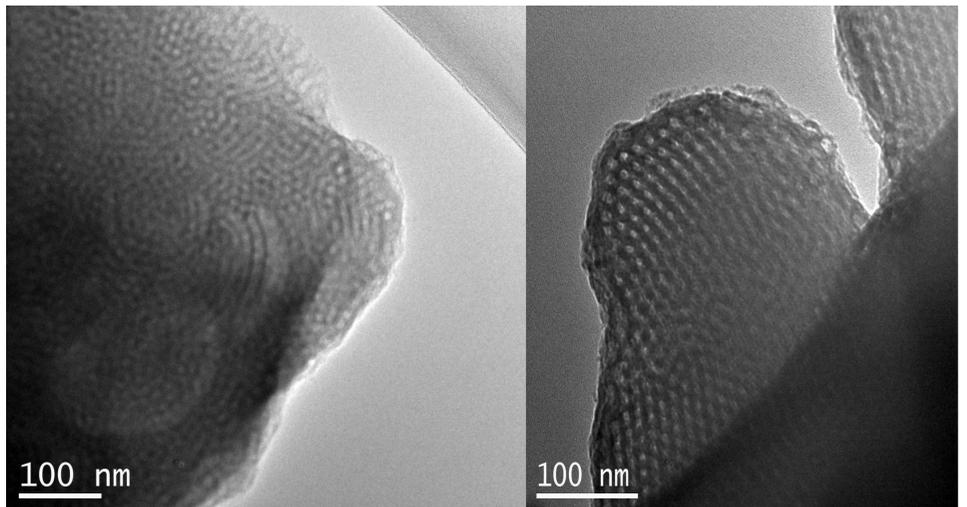


Figure 3: TEM Imaging of Vesicle-like mesoporous silica

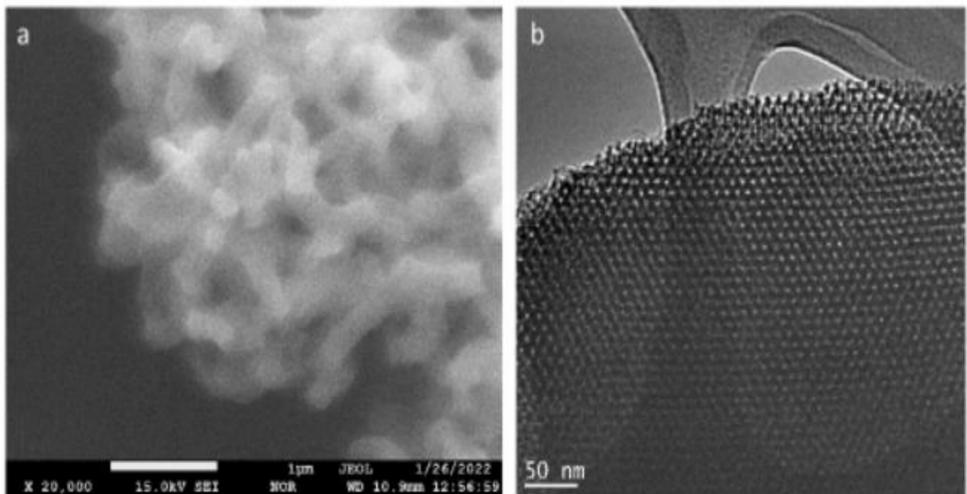


Figure 4: SEM and TEM images of rod-like mesoporous silica

## Findings and conclusion

- We are investigating mesoporous nanoparticles in different morphologies serving the materials platform.
- The imaging results show channels which proves the pores in the structure for biomarker functionalization.
- It can be observed from the image the concentric nature of the structure although not uniform throughout the structure which is a result of the vesicle-like shape under study.
- Due to the non-uniform concentric structure of the mesoporous silica, it was concluded that although the methodology for the sample preparation was feasible, review and adjustments need to be made to obtain the uniform concentric structure.

## CONTINUOUS AND FUTURE WORKS

- Imaging Scanning Electron Microscopy of both the Vesicle-like mesoporous silica and the gold nano particles would be analyzed to determine the morphology of their structure.
- There would be a careful review and remodeling of the methodology for the synthesis of the vesicle-like mesoporous silica in order to generate a uniform concentric structure throughout the material
- After the uniform structure has been obtained, the two synthesized particles which are the Gold nano particles and the vesicle-like mesoporous structure would be merged to form the Janus particle.

## REFERENCES

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