



## INTRODUCTION

The loss of bone mineral as one ages is fairly common which can result in conditions such as **osteoporosis** that leads to the breakage of bones. There is a growing interest in replacing the current titanium and metal alloy bone fixation implants with non-metal-fixation devices, specifically using a sol-gel derived hydroxyapatite (HA) as a non-metallic implant coating.

### Research Objectives

- ❖ Synthesize an alternative sol-gel derived HA with use of alternative calcium and phosphate precursors from that utilized in the BioICAS lab.
- ❖ **The sol-gel process:** a solution is formed from HA ceramic precursors (calcium nitrate tetrahydrate + triethyl phosphate) that subsequently undergoes hydrolysis and condensation reactions that results in the formation of a 3D gel. The wet gel is dried to form a xerogel that can be transformed into ceramic films or coatings.

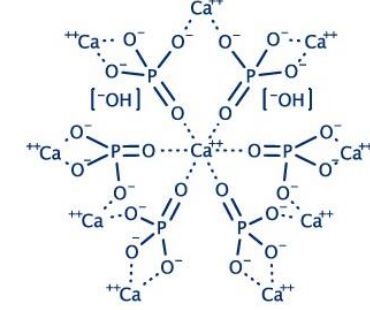
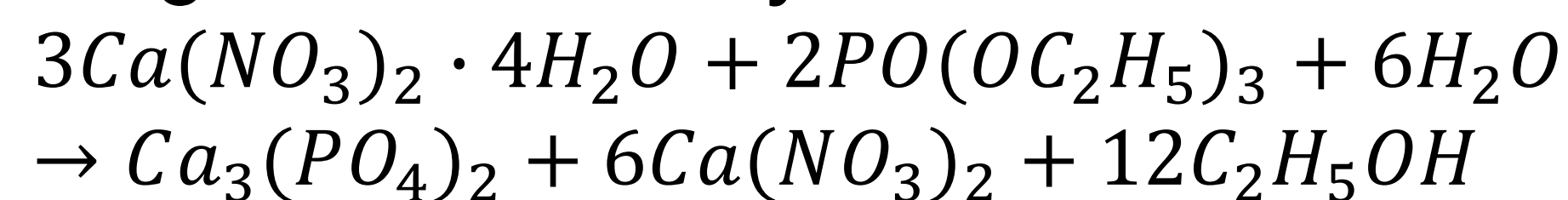


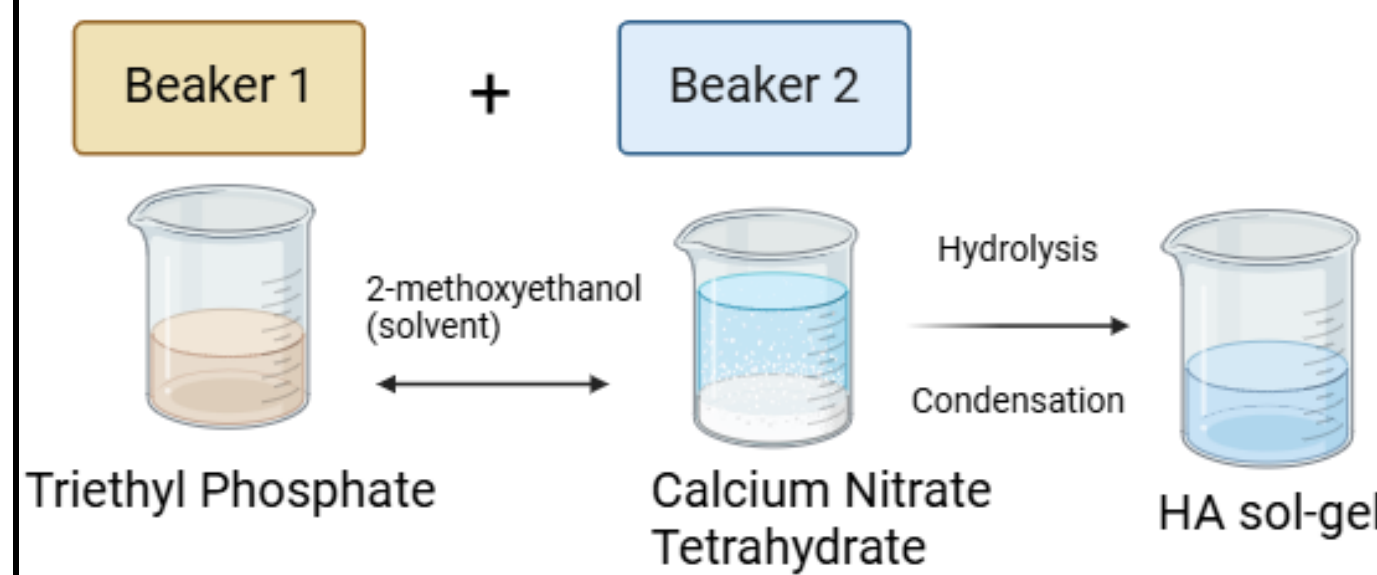
Fig 1. Chemical structure of HA

### HA Sol-gel Stoichiometry:



## METHODS

### 1. HA Sol-gel Synthesis



### 2. Sol-gel Characterization

- **Contact angle** to determine wettability
- **FTIR** for identification of chemical bonds

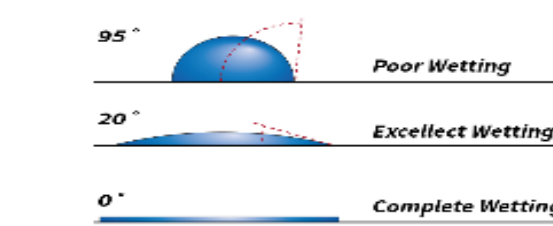
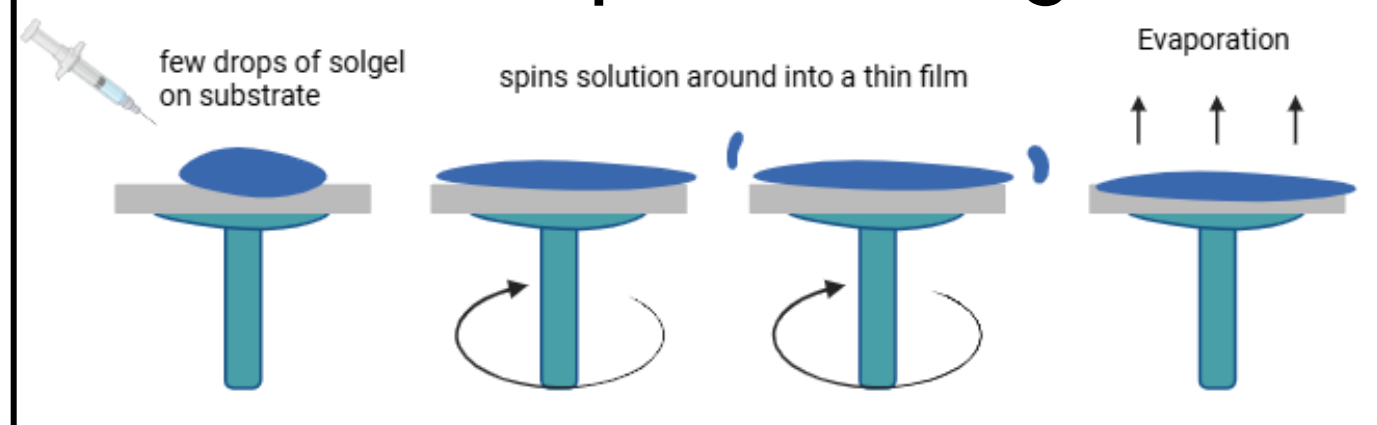
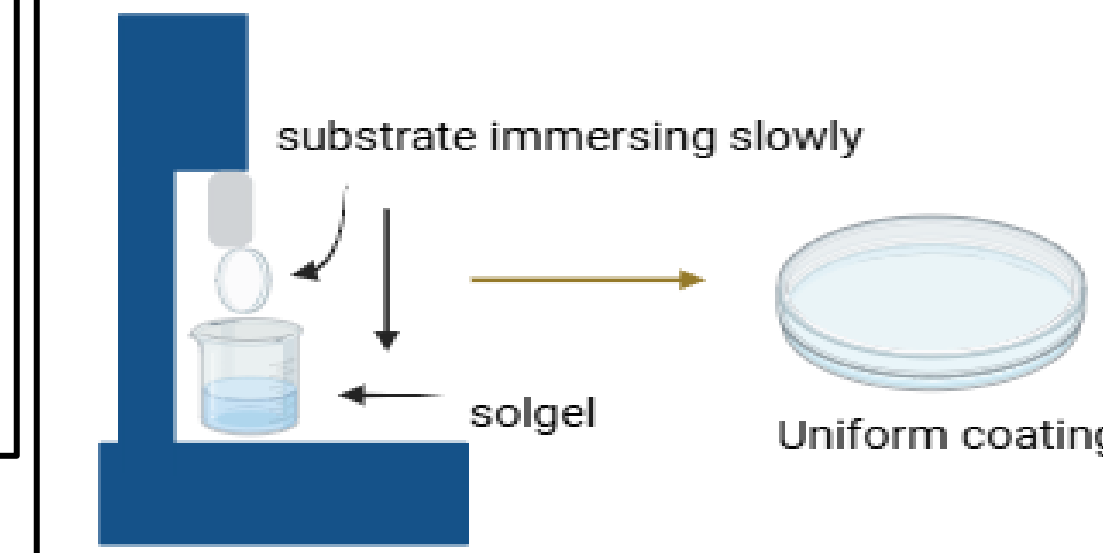


Fig 2. Contact Angle

### 3. Thin film Spin Coating



### 4. Dip Coating



### 5. Thin Film Characterization

## RESULTS



Fig 3. 0.02M sol-gel

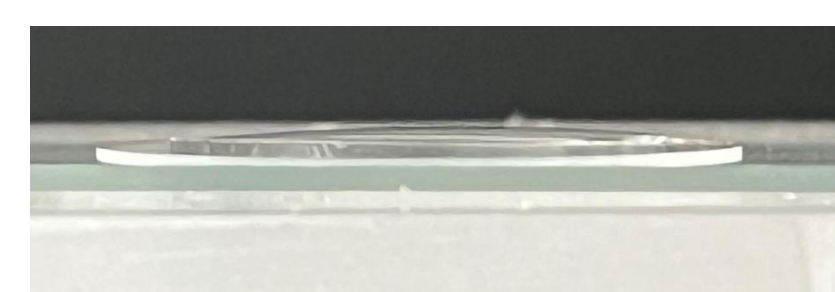


Fig 4. Sol-gel contact angle measurement on quartz glass ( $\theta = 7^\circ$ )

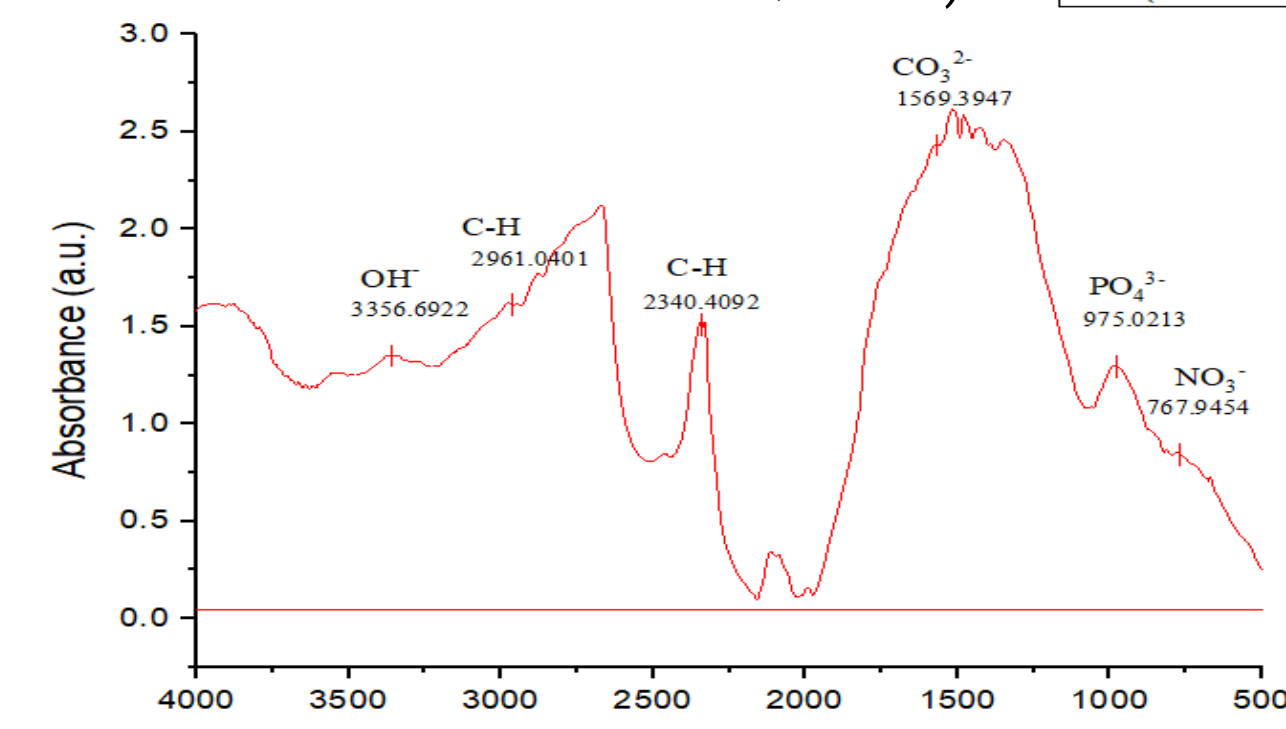


Fig 5. FTIR of sol-gel

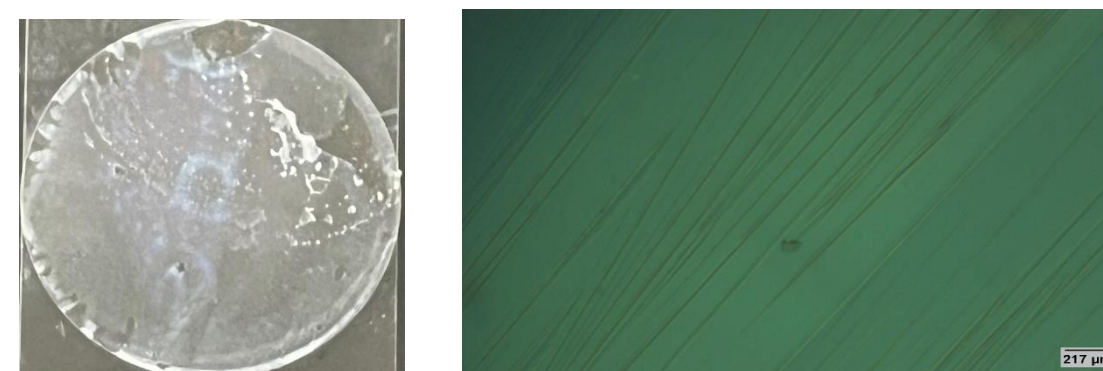


Fig 6. 1000 rpm spin coating & optical micrograph (100x)

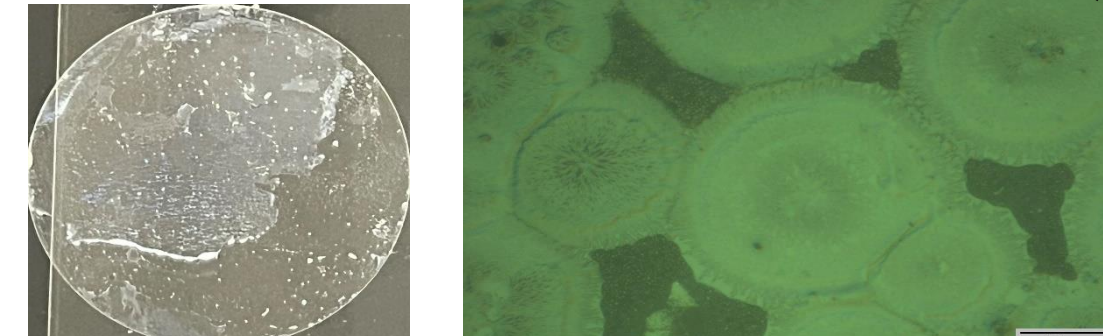


Fig 7. 1100 rpm spin coating & optical micrograph (100x)

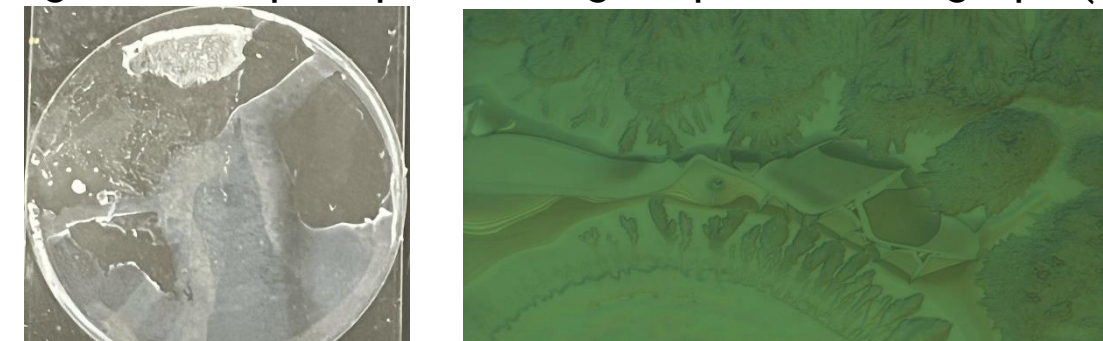


Fig 8. 2100 rpm spin coating & optical micrograph (200x)

## CONCLUSIONS

Using calcium nitrate tetrahydrate as the calcium precursor and triethyl phosphate as the phosphate precursor, the HA sol-gel was successfully made as seen through the mean contact angle being less than 90 degrees and the FTIR graph that shows the proper chemistry of HA precursors. Spin coated thin films showed a modest uniform coating indicating desired wettability possible.

### NEXT STEPS

- Create uniform spin coatings utilizing different spin rates
- Find best parameters for uniform dip coating
- Once proper coatings are developed, undergo a calcination process and XRD

## ACKNOWLEDGMENTS

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