



# Sodium Bisulfate

A chemical used in jewelry design for metal pickling

By Jingru Guo



# Metal Pickling



Pickling is a metal surface treatment used to remove oxide layer and impurities. A solution called pickle liquor, which usually contains acid, is used in this treatment. Pickling is commonly used in jewelry design field. There are two types of acid used for making pickle liquor, one is hydrochloric acid and the other one is sulfuric. The sample I used for taking images is a type of sulfuric acid crystal called sodium bisulfate. Below is the comparison of two types of acid.

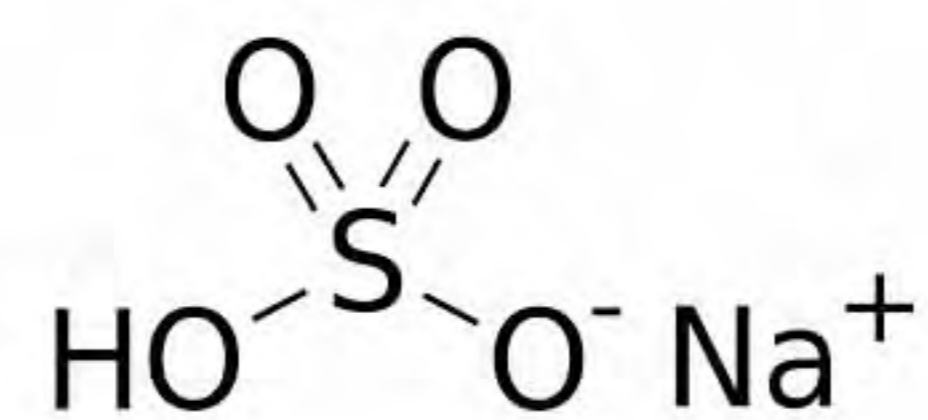
- Hydrochloric**
- Reduce heating costs since pickling solutions are used at room temperature
  - More extensive scale removal
  - Less penetration of hydrogen by diffusion
  - Less deposition of iron salts on the pickled surface
- Sulfuric**
- Acid can be renewed more frequently
  - Raising temperature will allow lower acid concentrations to pickle effectively
  - Ease of recovering iron sulfate
  - The rate of pickling can be controlled by varying the temperature



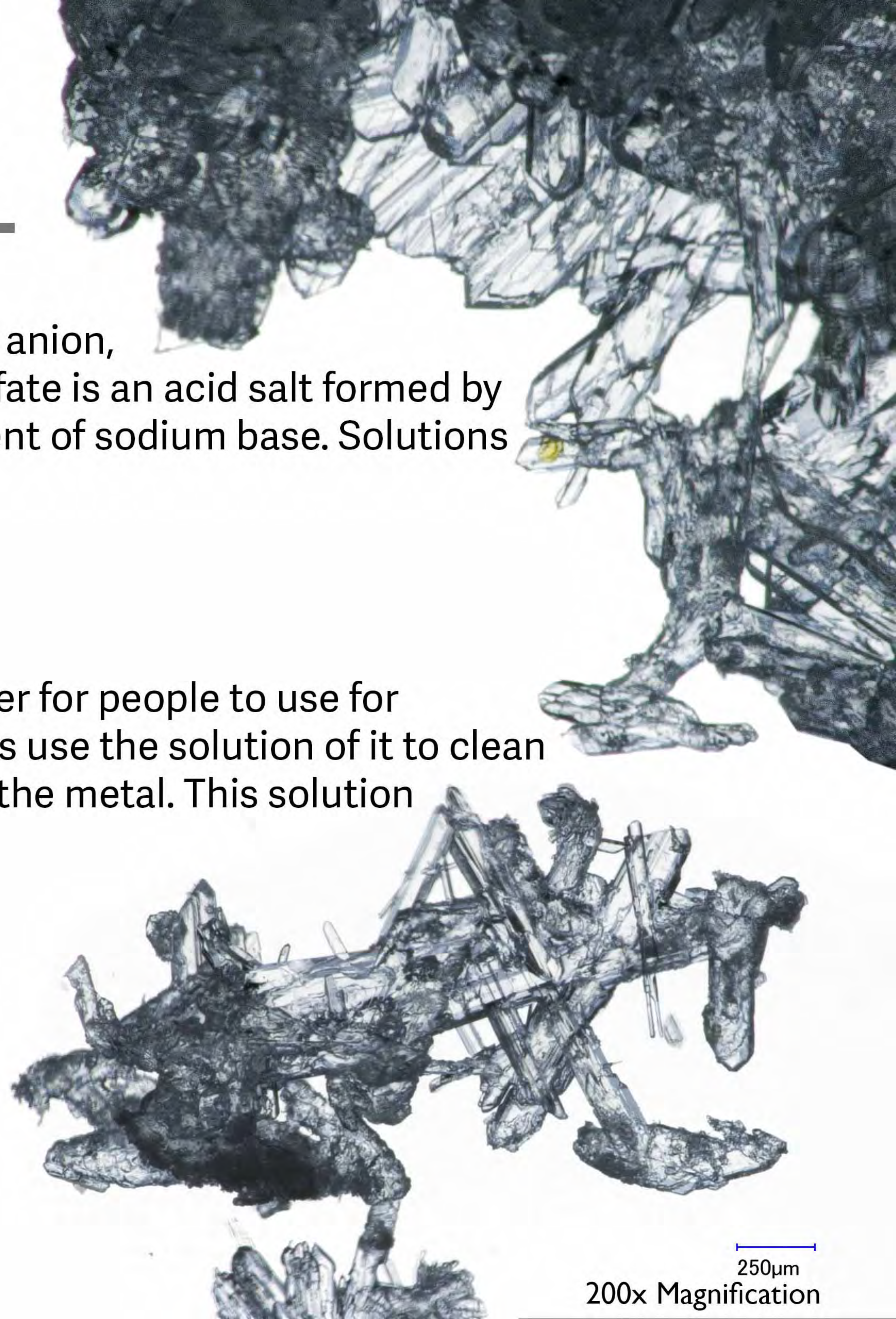
# Sodium Bisulfate

Sodium bisulfate is the sodium salt of the bisulfate anion, with the molecular formula  $\text{NaHSO}_4$ . Sodium bisulfate is an acid salt formed by partial neutralization of sulfuric acid by an equivalent of sodium base. Solutions of sodium bisulfate are acidic.

Sodium bisulfate is a dry granular solid which is safer for people to use for practical purposes. In jewelry design field, designers use the solution of it to clean up the oxidation layer and heat scale after burning the metal. This solution can be used for silver, gold, copper, and brass etc.

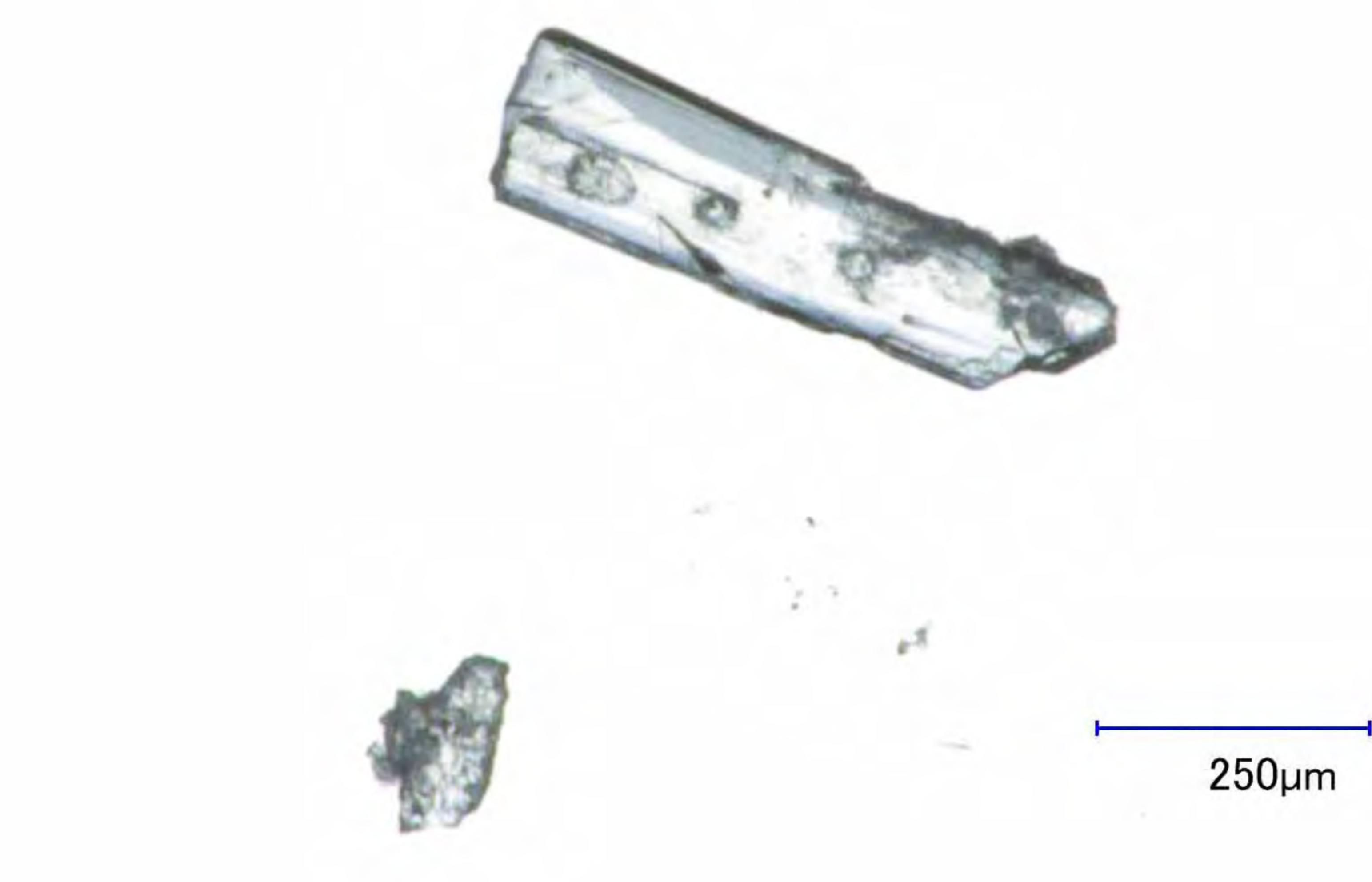
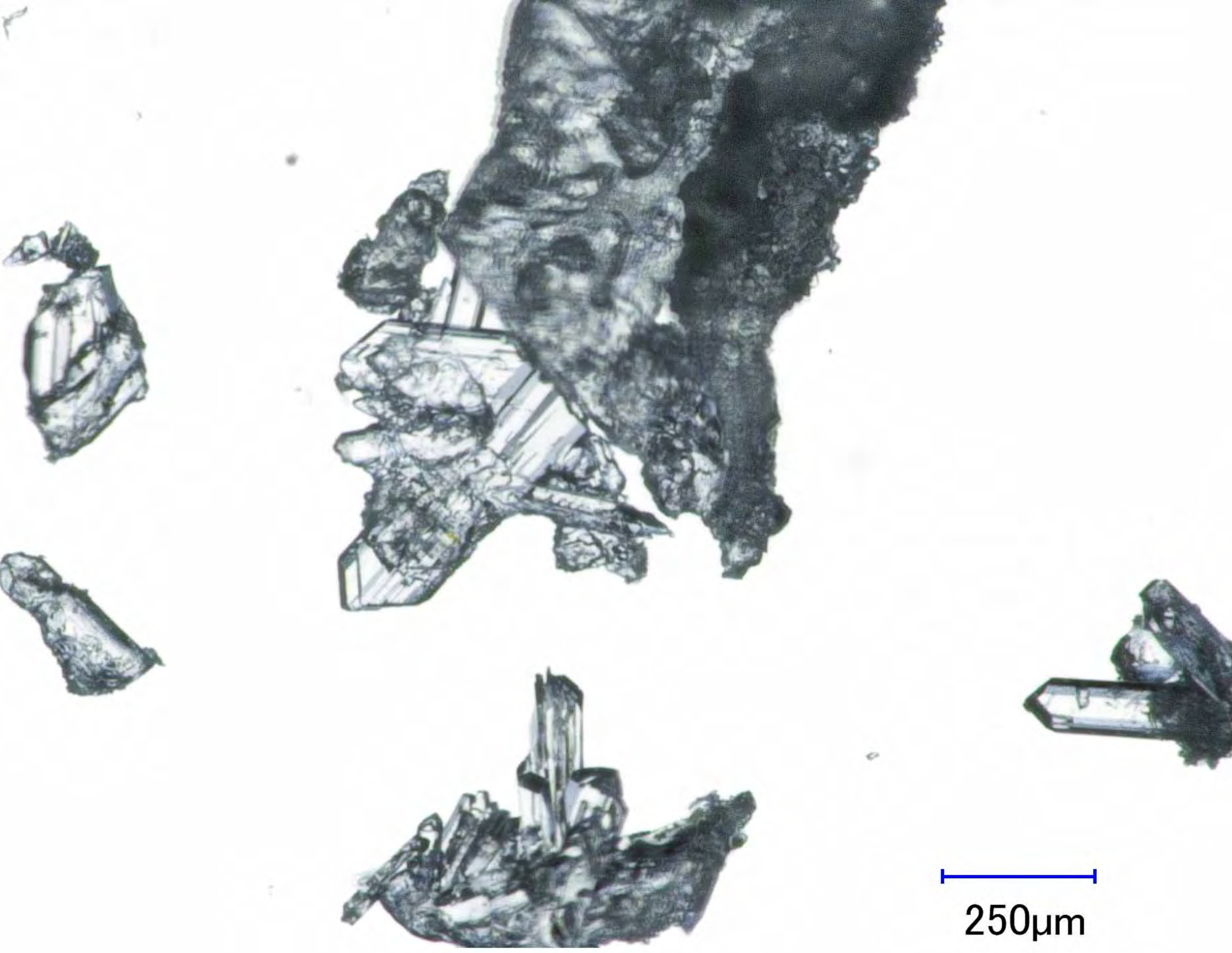


structural fomula of  $\text{NaHSO}_4$



250 $\mu\text{m}$   
200x Magnification



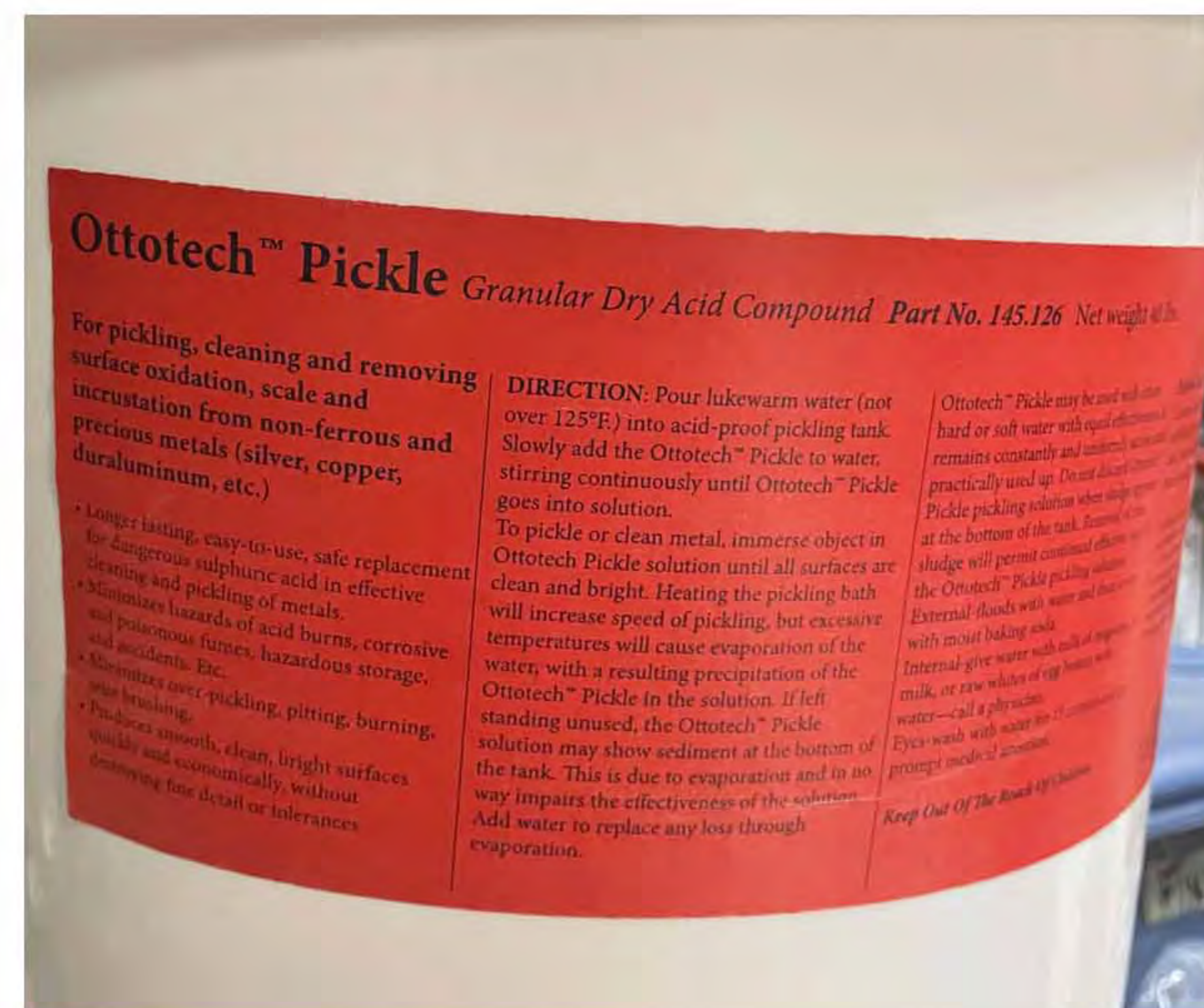


200x Magnification  
KEYENCE Digital Microscope  
By Jingru Guo



# Sampling

I collected my image subject from a table in RIT jewelry design studio. These crystals formed when water evaporate from the supersaturated solution. The substrate used to make the solution is Ottotech Pickle.

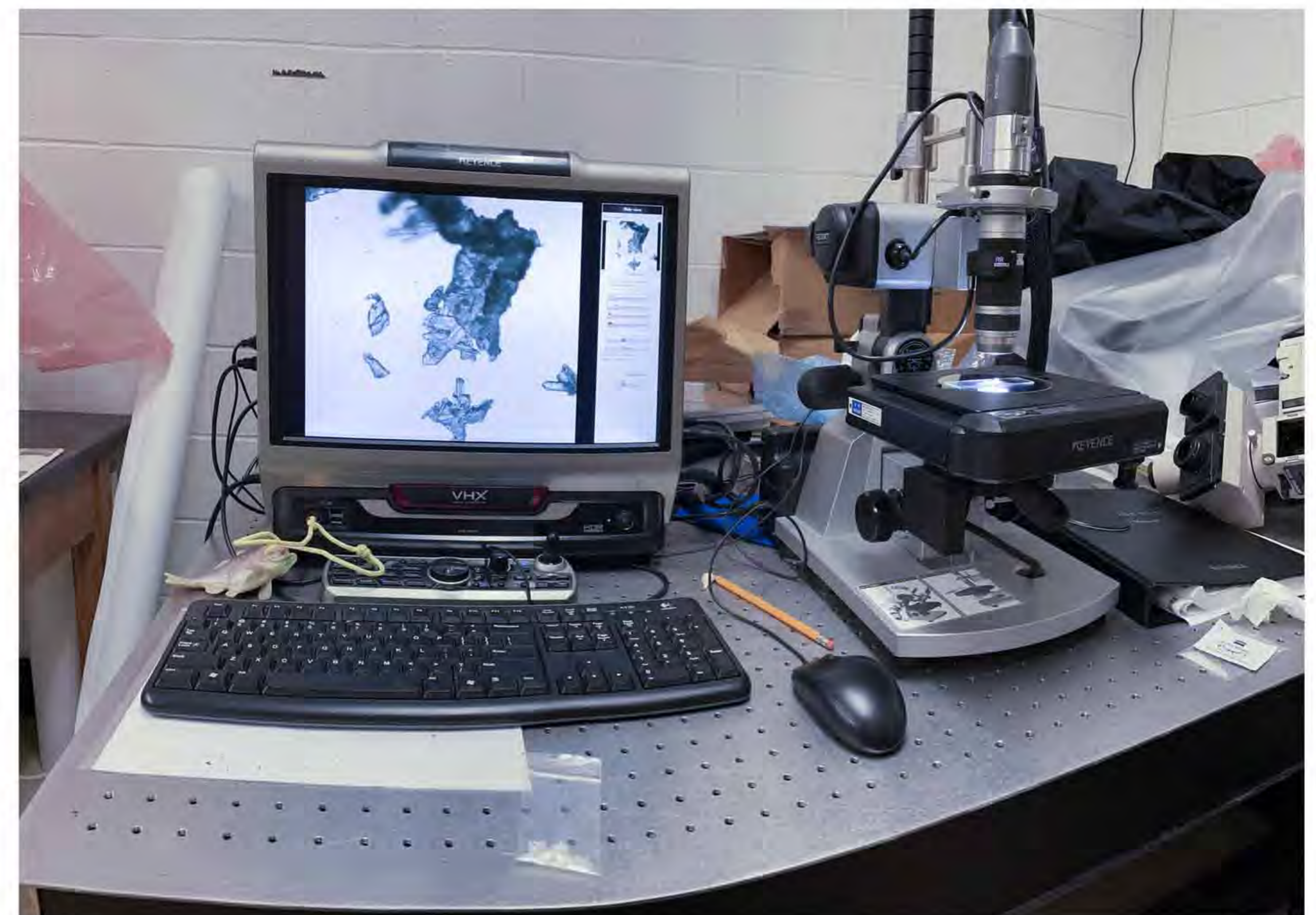
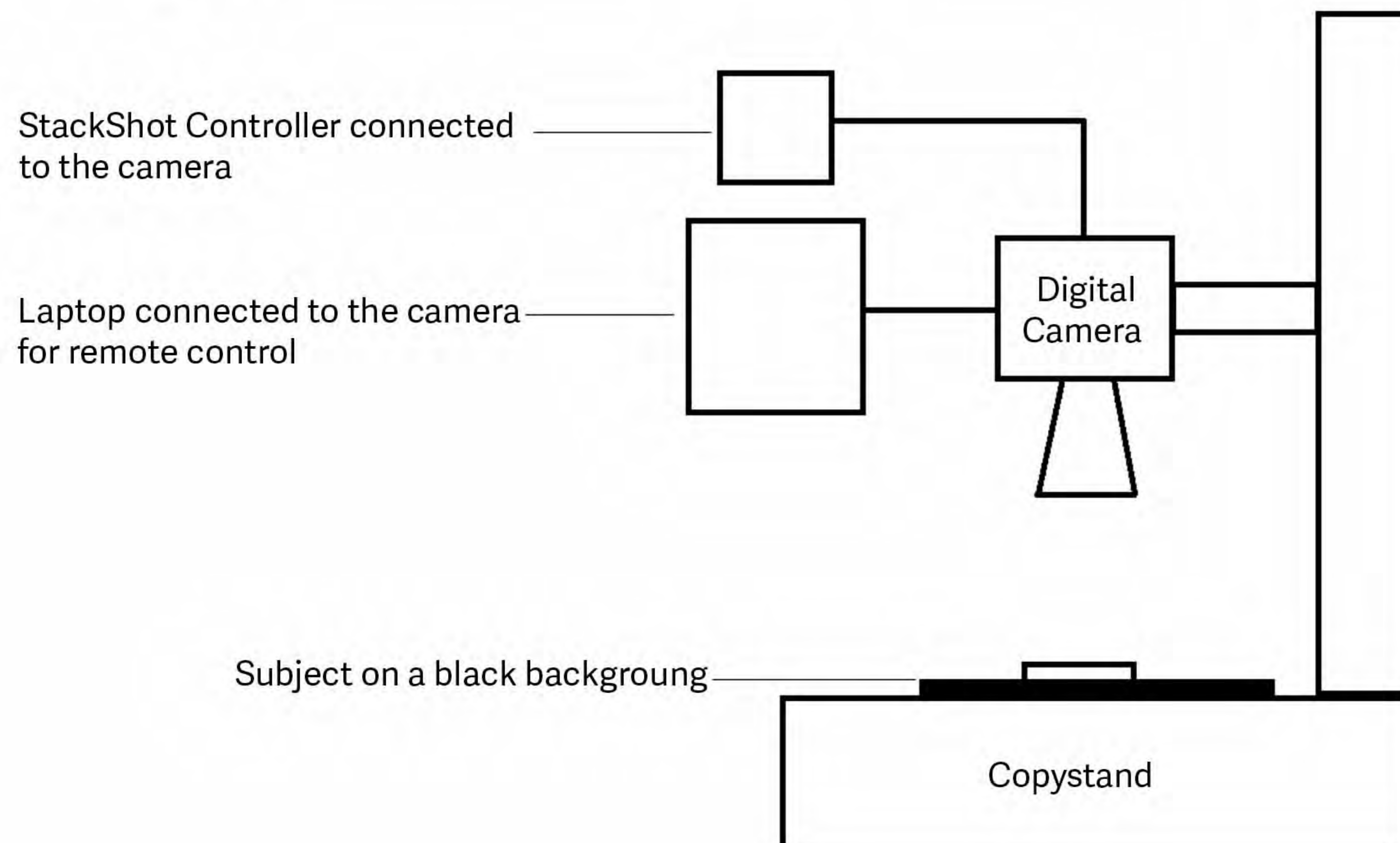




# Photography Setup

The dark-field images I presented in the first two pages were taken by Sony a7rIV with Laowa 25mm Ultra-Macro lens under 5x magnification. The setup diagram is on the bottom left.

All the bright-field 200x magnification images I presented were taken by KEYENCE digital Microscope. I put the subject on a microscope slide and turned on transmitted light under it. This microscope did photo stitching and focus stack to make a full composite while taking images.





# About the Author

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Jingru Guo is currently a senior photography science student in Rochester Institution of Technology. She is expected to graduate and have a Bachelor of Science degree in 2023. She has a great passion in taking high magnification images of wildlife and ores. And she loves insects.

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# References

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