

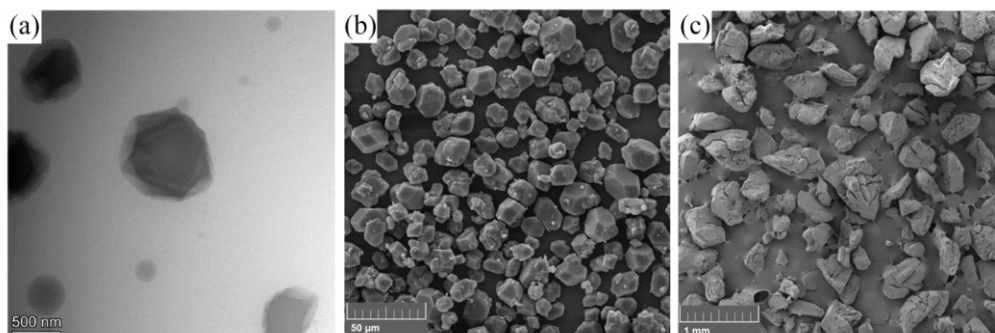
## Preparation of hemoglobin crystals of desired size

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The protein crystal has a wide range of potential applications (catalytic transformation, cell imaging and drug delivery) due to its highly ordered morphology. The hemoglobin, as the earliest discovered protein that can be crystallization, is the most commonly used protein crystal due to its mature crystallization process, lower cost, extensive source and can be mass produced. The protein crystal are generally prepared by vapor diffusion crystallization which already realize the size-controllable protein crystal in millimeter level. However, the preparation of protein crystal with micro-nano scale remains a challenge, which limits the application in the field of material science. In this study, the hemoglobin crystals in micron scale were prepared by stirring to make dense liquid phase well dispersive in the process of vapor diffusion crystallization, and successfully obtain the hemoglobin crystals around the size of 20  $\mu\text{m}$ . Furthermore, nano-crystals were obtained by the water-in-oil micro-emulsion method. This work will boost the application of hemoglobin crystals in functional materials. Our next research will focus on the water-in-oil micro-emulsion process' optimization to realize size-controllable and fine reproducibility.



**Figure 1** Characterization of hemoglobin crystals. (a) Transmission electron microscopy images of hemoglobin crystals in nano-scale; (b) Scanning electron microscopy images of hemoglobin crystals in micro-scale; (c) Scanning electron microscopy images of hemoglobin crystals in milli-scale.

**Keywords:** crystallization; hemoglobin crystals; micro-scale; micro-emulsion

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