

Influence of Crystallization Rate on Structure of AgBr Emulsion Microcrystals.

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Abstract

In our paper we have investigated structure of AgBr microcrystals of the cubic shape in dependence on crystallization rate. The microcrystals have been synthesized by a method of the controlled double-jet precipitation at different additional rate crystallization. To reveal structure of formed microcrystals gelatine-free surface of the microcrystals was etched by either $\text{Na}_2\text{S}_2\text{O}_3$ solution or KCNS one gradually varied time. A surface modified by this way has been investigated with a transmission electron microscopy by a method of carbon replicas.

Various character of an etching of microcrystals has been observed in dependence on its crystallization rate. In our opinion, such dependence can be explained by variation microcrystals structure with variation of crystallization rate. For example, it has been shown that a high crystallization rate results in formation of block structure on the etched surface of the cubic microcrystals.

Introduction

The shape and structure of silver halide crystals are the important factors influencing on properties of photosensitive materials. Therefore it is interesting to investigate the dependence of microcrystals structure on crystallization rate. In represented paper ArBr microcrystals of cubic shape were investigated.

Experimental and Results

To reach this aim, AgBr cubic microcrystals have been synthesized by double-jet addition of AgNO_3 and KBr solutions in reaction vessel at addition rates 4×10^{-6} mol/l (microcrystals of 1st type) and 8.7×10^{-6} mol/l (microcrystals of 2nd type). Time of synthesis has been made 26 min and 12 min accordingly. In results microcrystals with 0.47μ and 0.57μ size were obtained accordingly. To reveal structure of formed microcrystals, its were separated from gelatins. In the next step, a gelatin-free surface of the microcrystals was etched by either 1% $\text{Na}_2\text{S}_2\text{O}_3$ solution or 1% KCNS one, gradually varied time. A surface modified by this way has been investigated with a transmission electron microscopy by method of carbon replicas.

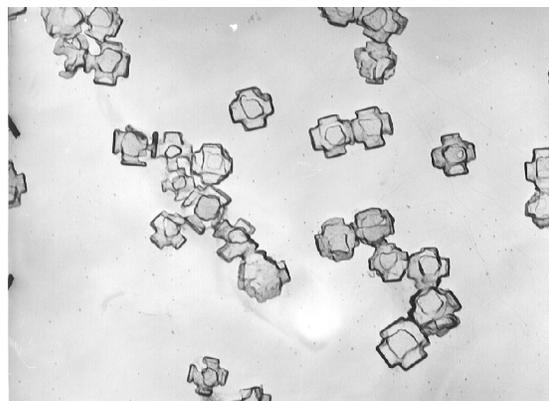


Fig.1 Micrograph of AgBr microcrystals of 1st type sampled at 10 min after start of etching in 1% $\text{Na}_2\text{S}_2\text{O}_3$ solution. Magnification 10000 \times .

In result the following features of etching of AgBr

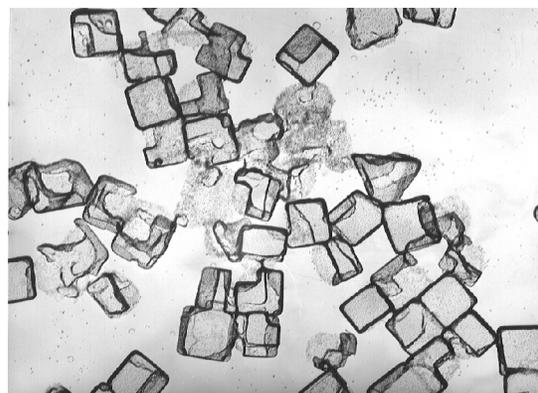


Fig.2 Micrograph of AgBr microcrystals of 2nd type sampled at 10 min after start of etching in 1% $\text{Na}_2\text{S}_2\text{O}_3$ solution. Magnification 10000 \times .

microcrystals of 1st and 2nd type by $\text{Na}_2\text{S}_2\text{O}_3$ solution were revealed. The process of etching of microcrystals of 1st type began from edges of crystals, to direction $\langle 110 \rangle$. Figure 1 shows electronmicrograph of microcrystals of 1st type sampled at 10 min after start of etching. The process of etching proceeds regularly to all directions with higher rate to direction $\langle 110 \rangle$ in comparison with one to direction $\langle 110 \rangle$. The etching of microcrystals of 2nd type began selectively. The separate parts or blocks of a crystal were dissolved, while other part of a crystal remained without

change. Electronmicrograph of microcrystals of 2nd type sampled at 10 min after start of etching shown on figure 2.

The similar character of etching by a solution KCNS was observed.

Difference of the observed pattern of etching we connect to variation of the microcrystals structure at variation crystallization rate. In our opinion the observed character of etching can be explained by the following. Microcrystals, formed at low crystallization rate, have more perfect

structure in comparison with microcrystals, formed at high crystallization rate.

Conclusion

Shown the dependence between character of etching of microcrystals and its crystallization rate, that in our opinion is connected to variation of microcrystals structure at variation of crystallization rate. The obtained results can be useful at discussion of growth mechanisms of emulsion microcrystals.