Light-thermal Sensitive Imaging System

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Abstract

A silver-free photo-thermal sensitive imaging system capturing photo-imaging with photo-thermal microcapsules and developer outside is described. Microcapsules here contain photo-sensitive mixture of photo-initiator, photo-curing compound and colorless dye precursors. The exposed microcapsules will cure and won't form image when it was heated but the unexposed microcapsules will develop. Microcapsules with size smaller than 1 um have been first synthesized using technique of interface polymerization, and act as basic imaging cell. As the size of the microcapsules can match AgX crystal in the commerce film, so the resolving power of the image system may be excellent. At the same time, the film with the technology will be cheap and friendly to environment.

Experiment

The colorless dye precursors comprising ODB-2(trade name; manufactured by YAMAMOTO CHEMICALS.INC) 15 grams and CK-16(trade name; manufactured by Longsheng Chemical Co.) 10 grams was put into a beaker, and was mixed with 20g ethyl acetate as solvent, 10g UV7600(Aliphatic urethane acrylate, manufactured by Nippon Synthetic Chemical Industry Co.Ltd), 8g TMPTA(trimethylolpropane triacrylate) as photo-curing compounds, Then the mixture was heated to dissolve. When the solution was cooled to room temperature, 60g D110N(trade name: manufactured by Mitsui Takeda Chemical Co. Ltd) as one of the microcapsules wall forming materials, and the photo-initiator was added at safe light. Then the oil phase or the core was obtained.

The oil phase was put into a 25℃ solution comprising 400ml PVA 224(4.5%)and 20g 7#(3-[N-Dodecyl-N,N-dimethyl-aminium]-2-hydroxy-propylsulfonate)(80g/L) surfactant, The mixture was emulsified with a high shear mixer at 8000 rpm for 9 minutes. 8.0g of diethylentriamine (DETA) in 500 g of water were added. The emulsion was heated to 60℃, emulsified for another 30 minutes, stirred at 700 rpm by using an overhead stirrer for three hours at 60℃, and overnight at room temperature to complete the capsule formation. The average size was determined by Coulter Counter to be about 0.8mu.m.

At the same time, the developer dispersion prepared by the similar method include hydroxy benzyl benzoate (HBB), bis(3-allyl-4-hydroxyphenyl)sulfone-) (TGSA) was obtained.

22 g of the microcapsules (12% solid), 24 g of HBB developer dispersion (14% solid), 1 g of 12#(Sodium 1,2-di-(octyloxycarbonyl)ethane sulphonate)（80g/L）surfactant, and 0.5 g glycerin were mixed thoroughly to give a solid mixture. pH was adjusted to 8.0 with 20% sodium carbonate solution in water. The mixture was coated onto a 175mu.m blue PET film by a 250 bar and dried at 50℃ to obtain the light-thermal sensitive recording material. The dry thickness was measured about 21mu.m.

The light-thermal sensitive recording material was exposured by mercury-arc lamp at 43cm distance, the exposure time was 10, 30, 50, 70, 90, 110 sec. The recording material after being exposured was heated at 100 C and 110 C for 3sec to achieve certain density. Then , the different density was measured by densitometer.

Results

1. **microcapsules**

The distribution of the microcapsules diameter as picture 1, and the EMS of the microcapsules as picture 2.

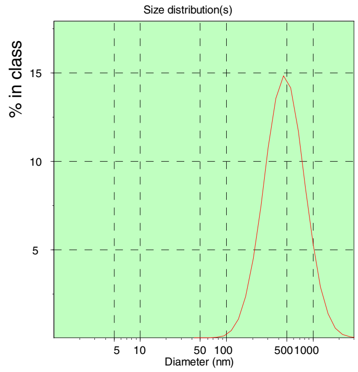
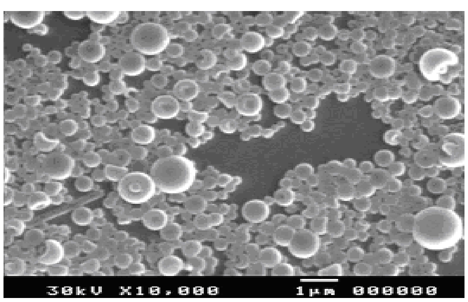


Figure 1.

From picture 1, the diameter of the light-thermal microcapsules was 466mu.m, it was in the range of the diameter of AgX grain in the photo-sensitive AgX film, so the resolving power of the light-thermal sensitive recording material formed by the microcapsules could reach even better than that of AgX film. And because the recording material was simple process after being exposured by heater, water and developer solution was not necessary, it would be cheaper and friendly to environment than AgX film.

light-thermal character

The light-thermal recording material was processed. The density of the unexposed area was higher than the exposed area. The relation between exposure time and density of the recording material was obtained in table 1 and the curve was obtained in picture 3.



Picture 2 EMS of the capsule

Table 1. exposed time and temperature of develop

	100° C	110° C
0sec	1.29	1.6
10sec	1.01	1.3
30sec	1.15	1.44
50sec	1.06	1.36
70sec	1.1	1.38
90sec	1.04	1.3
110sec	0.71	1.12

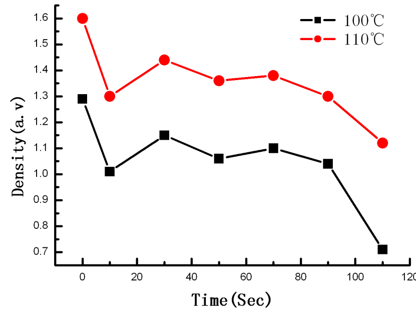


Figure 3 .

discussion

From the table 1 and picture 3, we see that the density of the exposed area descended when the exposure time ascended. Because when the recording material was exposed by mercury-arc lamp, the photo-curing compounds in the microcapsule cured, the penetrability of the microcapsule core descended, so it become difficult that the developer outside the microcapsule penetrate the wall and the cured core.

Conclusion

The light-thermal microcapsules with size smaller than 1 um have been synthesized using technique of interface polymerization, and act as basic imaging cell, the light-thermal recording material was obtained. As the size of the microcapsules can match AgX crystal in the commerce film, so the resolving power of the image system may be excellent. At the same time, the film with the technology will be cheap and friendly to environment.

Biography

Jiang Xiao-li received his B.S. degree in Chemistry from Jilin University in 1995. Since 1995 he has worked in AgX Materials Department of Research and Development Institute in China Lucky Film Corp., . His work has primarily focused on the research and development of black and white imaging materials. In May 2002 he started his Ph.D. thesis at College of Physics Science and Technology, Hebei University

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