Preparation of a Novel Coating for Pressing Paper-base Laser Holography Image and Its Application in Anti-counterfeiting Package

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Abstract: A novel coating is synthesized by co-polymerization of four monomers: methyl methacrylate (MMA), butyl methacrylate (BMA), butyl acrylate (BA) and methacrylic acid (MAA). The impacts of the polymerization time on the degree of unsaturation are discussed; the impacts of the composition of monomers on the paint performance are studied and the factor influencing of the diffraction efficiency on recording process of laser holography imaging are discussed. The results show that the solid content of the paint is 49.9%, the film pencil hardness is H, the resistivity against water and the wearability are good, the glossiness reaches 90.5 Gs and the diffraction efficiency is 7.1% from the laser holpgraphy images recorded by the coating when the composition of MMA:BMA:BA:MAA is 60:30:5:5 and the polymerization time is 5 h.

Key words: laser holpgraphy image; anti-counterfeit package; paper-base; coating
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The pressing technology of laser holography image has played an important role in anti-counterfeiting package[1]. In this paper, a novel coating was synthesized by co-polymerization of four monomers: methyl methacrylate (MMA), butyl methacrylate (BMA), butyl acrylate (BA) and methacrylic acid (MAA). It can record laser holpgraphy image in a big area and is friendly to the environment. The experiment results showed that this material can record holography image satisfactorily and can replace gloss varnish for paper with protection of the press surface[2]. Its surface has the advantages of lubricous, water-resistant, wear-resistant, chemical tolerant and etc, which makes it an ideal product in anti-counterfeiting packaging.

1 Experiments

The resin was synthesized and measured accurately with Chemical additives (dispersant, antifoam, levelling agent) and then added into the container in the high-speed dispersing machine for 15 min to disperse the auxiliary agent completely.

The paper-based material was glazed (coating content was 8 ~ 10 g/m²) oven dried (60 ~ 80 ℃, 15 s) and pressed polish by calender and then pressed holographic image[2] in the condition of not impacting the inherent press effect.

2 Results and discussions

2.1 Impacts of the monomer composition on properties of the holpgraphy imaging

It is indicated from table 1 that the Tg is higher, the machine performance of the paint is better and the diffraction efficiency is higher. So the best ratio of MMA:BMA:BA:MAA is 60:30:5:5.

Tab. 1 Impact of ratio of monomer on coat performance

MMA:BMA:BA:MAA	Tg /℃	Brinell hardness	Brightness /Gs	Diffraction efficiency /%
20:70:5:5	34	<B	86.2	2.1
30:60:5:5	41.5	B	87.7	3.5
50:40:5:5	58.7	<H	90.2	4.8
60:30:5:5	66.1	H	90.5	7.1
70:20:5:5	75.2	2H	91.4	7.2

2.2 Impacts of the polymerization time

It is indicated from Fig. 1 that the presence of evident unsaturation double bond characteristic absorption peaks is at 1635.4 when the polyreaction lasts 1 h, the

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peak becomes weak evidently 3 h later, and nearly disappears 5 h later, which show that the degree of unsaturation in this system decreases gradually with the time increasing. The polyreaction is sufficient when the reaction time is 5 h. Therefore the optimal polymerization time is about 5 h.

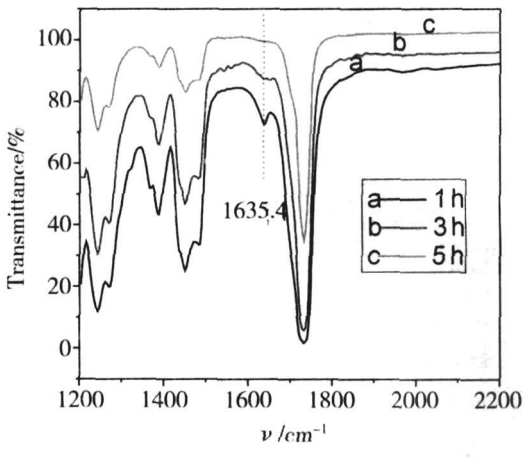

Fig. 1　IR spectrum of the resin in different polymerization time

2.3　Influences of background color on diffraction efficiency

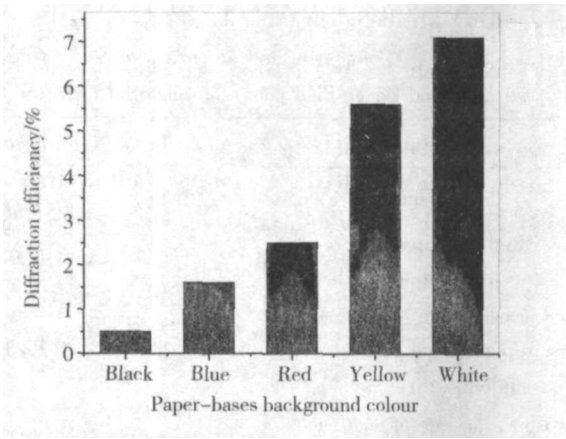

Fig. 2　Plot of paper-base background color vs diffraction efficiency

It is concluded from Fig. 2 that the diffraction efficiency of the white was 10 times more than that of the black on the same base materials. The reason is that different color has different light absorption rate. It is luck that it is the lightness, not diffraction rate be perceptedby consumer dierctly when holography paper is taken as a commercial product. The bigger the contrastivity of holography effect and background color, the bigger the lightness.

3　Conclusion

In response to the current counterfeiting problem, a novel coating for creating holography imaging on printing surface was created. Large-scale laser holography images were replicated on printing surface immediately by used it. Consequently anti-counterfeiting marker and packaging were united which decreased the costing and improved the power of anti-counterfeiting. The results show that this coating is fits for creating holographic imaging.

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一种新型纸基激光全息图成像涂料的研究及其防伪应用

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摘　要：一种新型的激光全息图文成像涂料采用甲基丙烯酸甲酯（MMA）、甲基丙烯酸丁酯（BMA）、丙烯酸丁酯（BA）、甲基丙烯酸（MAA）共聚而成。研究了聚合反应时间对体系不饱和度的影响；探讨了共聚体系中各单体的组成对涂料性能的影响以及影响全息图衍射效率的相关因素。结果显示：当单体组成比 MMA∶BMA∶BA∶MAA为 60∶30∶5∶5，反应时间为 5 h时，得到的树脂固含量为 49.9%，铅笔硬度为 H，涂膜的耐水性和耐磨擦性能优良，光泽度高达 90.5Gs；全息图的衍射效率达到 7.1%。

关键词：激光全息图像；防伪包装；纸基材；涂料

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