

Research paper

Application of Nanosericite to LWC Paper

Yuan-Shing Perng,¹⁾ Eugene I-Chen Wang,^{2,4)} Ming-Jie Liu,¹⁾ Lan Sheng Kuo³⁾

【 Summary 】

The purpose of this study was to investigate the effects on coating color and coated paper when nano-scale sericite was substituted for a portion of the latex binder. The coating formulation was based on a lightweight coated (LWC) paper coating. Dosages of nanosericite were 0, 0.1, 0.2, 0.3, 0.5, 0.7, and 1.0 parts per hundred of the total color pigments. Respective latex dosages were 11.2, 11.1, 11.0, 10.9, 10.7, 10.5, and 10.2 parts per hundred of the total color pigments. The coating weight was controlled to 8.5 g m⁻² on one side. There were 10 experimental sets (including 2 sets of replications) in total. The results indicated that in terms of the coating color properties, adding nanosericite tended to reduce the water retention property and increased both the low- and high-shear viscosities; however, the color remained applicable. Substituting a portion of the latex with nanosericite as a co-binder did not affect the RI dry- and wet-peeling strengths of the coated paper, while paper opacity and brightness showed some improvements. Examination of CIE L*a*b* values of the coated paper suggested that the tint of the paper shifted from a greenish-yellow to a reddish-blue tone. The coated paper with modified color tended to have increased smoothness and decreased roughness; however, at both lower and the highest nanosericite dosages, the effects were reversed. The modification did not affect the unprinted gloss, but caused an increase in post-printing gloss levels.

Key words: nanosericite, coated paper, latex, brightness, opacity.

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研究報告

奈米級絹雲母在輕量塗布紙的應用

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摘 要

本研究目的為探討奈米級絹雲母取代乳膠在輕量塗布紙應用時，對於塗料性質及塗布紙性質的影響。塗料配方以典型輕量塗布紙(LWC)塗料為基準，奈米級絹雲母添加量分別為0、0.1、0.2、0.3、0.5、0.7、1.0對顏料百分量($\text{g } 100 \text{ g}^{-1}$)，而乳膠添加量為11.2、11.1、11.0、10.9、10.7、10.5、10.2對顏料百分量，塗布量控制在 8.5 g m^{-2} ，總實驗組數為10組(含2組重複實驗)。實驗結果顯示，奈米級絹雲母會降低塗料保水性、提高低剪力黏度及高剪力黏度，但塗料仍在可操作範圍。以奈米級絹雲母可以取代部份乳膠，作為輔助接著劑，不會影響塗布紙RI乾剝強度及RI濕剝強度；可以改善塗布紙不透明度及白度等光學性質，紙色從綠-黃轉為紅-藍，會提高紙張表面平滑度及降低粗糙度，但在低與高劑量添加時，則產生平滑度下降且提高粗糙度。改質後之塗布紙不會影響塗布紙印刷前之光澤度表現，但可提升印刷後之光澤度。

關鍵詞：奈米絹雲母、塗布紙、乳膠、白度、不透明度。

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INTRODUCTION

Sericite is a native mica mineral mined in eastern Taiwan. It is a lustrous layered powder mainly composed of silicone dioxide and aluminum oxide, with the empirical formula of $\text{KAl}_2(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2$. The average particle size of the mineral is about 10~14 μm . Typical sericite has a 3-layer unit cell consisting of a SiO_2 tetrahedron- Al_2O_3 octahedron- SiO_2 tetrahedron structure. Between the layers are potassium ionic bonds which hold the layers together. Because the potassium ions are usually not hydrated, it has a relatively high ion exchange capacity (IEC) of about 5 meq g^{-1} , and hence is potentially capable of exfoliating or delaminating. However, it is unlikely to delaminate merely by absorbing water and swelling (Anon 1984, Tsai 1989, Osman et al. 1999). By intercalating micrometer-scale sericite with caustic soda and performing

subsequent surface-modification treatments, nano-scale sericite can be obtained. Figure 1 shows photomicrographs of the mineral before and after heating with an NaOH solution. Transmission electron micrographs (TEMs) of the resulting nanosericite are shown in Fig. 2. It appears that nanosericite exists as irregular platy aggregates with an average particle size of 30 nm. The original sericite mica has a specific surface area of ca. 3 $\text{m}^2 \text{ g}^{-1}$; nanosericite, however, has a much expanded specific surface area of 205 $\text{m}^2 \text{ g}^{-1}$ (Perng et al. 2008a).

Micrometer-scale sericite is applied to papermaking wet end as a functional filler and tends to increase the sizing degree, ash retention, and bulk of the resulting paper, however, at a cost to paper brightness. On-machine tests also suggested that adding ser-

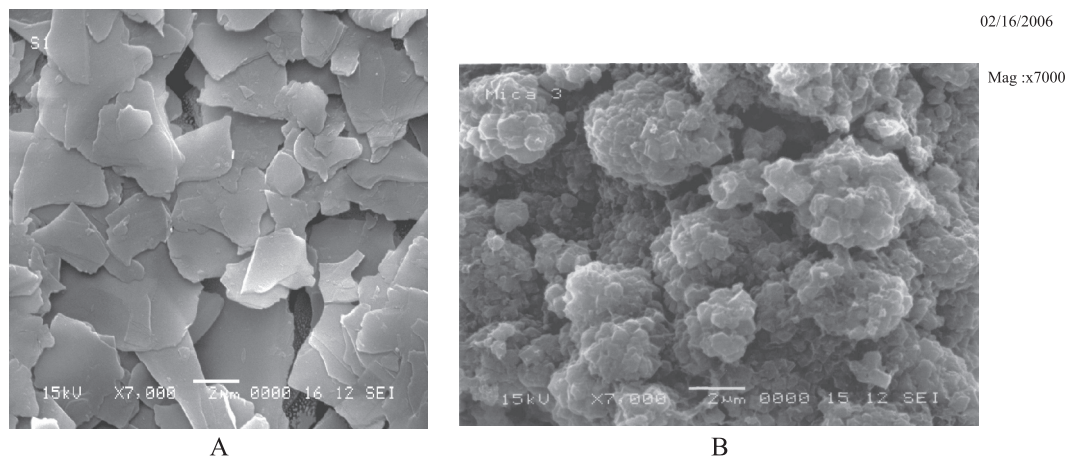


Fig. 1. SEM photomicrographs of natural sericite (A) and sericite after alkali intercalation (B).

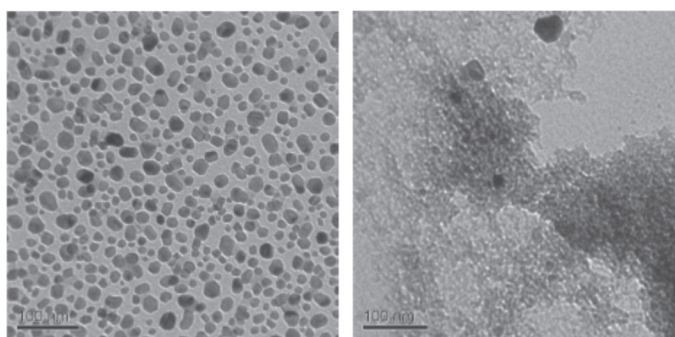


Fig. 2. TEM photomicrographs of nanosericite (10%).

icite can reduce the dosages of retention aids and sizing agents, and the filler flow rate. The resulting paper had simultaneously improved caliper, formation, air permeability, and roughness (Perng and Wang 2004). A nanosericite preparation obtained by a hot NaOH solution method was used in a colloidal silica dual-agent retention system and found to be a good auxiliary retention agent. Under suitable conditions, it enhanced the retention of ash (fillers) and also reduced the drainage time (Perng et al. 2008b).

In sericite applications to art paper and lightweight coated (LWC) formulations, substituting a portion of the clay with micrometer-scale sericite can improve the water retention

property of the color, and increase the opacity, IGT printability, and printing density, but at the expense of the brightness and gloss of the coated paper (Perng et al. 2006a, b, 2008a). Nanosericite prepared by grinding (average particle size ca. 102 nm) was incorporated in an LWC formulation and found to increase the water retention. The low-shear viscosity of the color, however, markedly increased. The gloss, smoothness, and post-printing gloss of the coated paper improved, however, the brightness and dry-peeling strength decreased (Lin et al. 2005, 2006).

In this study, we examined the effects of supplementing a portion of the coating binder latex with nanosericite on the color properties,

and on the optical, surface, and printability characteristics of the coated paper. For coating colors, the variables included pH, solids content, low- and high-shear viscosities, and water retention properties. For coated papers, the optical properties of brightness, opacity, gloss, and CIE L*a*b* values were examined; the surface properties included smoothness and roughness. For the printability properties, the RI dry- and wet-peeling strength, and IGT printability were measured.

MATERIALS AND METHODS

Materials

The coating base paper was made from a furnish containing bleached hardwood kraft pulp (BHKP) of mixed hardwood (mostly eucalypts) at 45 g m⁻², manufactured by Yuen Foong Yu Paper Co. (Jiutang, Taiwan). The brightness was 66.0% ISO, and opacity was 78%. The nanosericite pigment was Cami 605 (a translucent solution with a 3.5% solids content) from Sunshine Mineral (Taitung, Taiwan). The clay was α -gloss from J. M. Huber (Edison, NJ, USA). The ground calcium carbonate (GCC) was C-90 from Imery (Kaohsiung, Taiwan). The latex was a polystyrene butadiene resin (SBR), grade 780 SF (T_g 50°C, 185 nm) from Shin Foong Chemicals Industry (Fongshan, Taiwan). The potato starch was FT-70 from Avebe (Princeton, NJ, USA). The lubricant was LB-131 (a dispersed calcium stearate) from Hopax (Kaohsiung, Taiwan). The insolubilizer (melamine derivative resin) was SPI-102A from Sumitomo Chemicals (Osaka, Japan). The organic dispersant was

PA-40 from Hopax.

Methods

In this study, we used a typical LWC formulation to investigate the effects of replacing a portion of the binder latex with a preparation of nanosericite on the properties of the coating color and coated paper. Table 1 shows the color formulation which included a pigment mixture of clay: calcium carbonate at 40: 60, binder at 15.2 parts per hundred of the total pigment (composed of 11.2 parts latex and 4.0 parts starch). The coating color had a 60% solids content, and the pH of the color was adjusted to 9.0. Nanosericite dosages were 0, 0.1, 0.2, 0.3, 0.5, 0.7, and 1.0 parts per hundred of the total pigment, with corresponding latex dosages of 11.2, 11.1, 11.0, 10.9, 10.7, 10.5, and 10.2 parts per hundred of the total pigment. The coat weight was controlled to 8.5 g m⁻². There were 8 experimental sets, and 2 of the sets were randomly selected and replicated to estimate the standard deviation of the experiment. Thus, there were 10 sets in total, and for each set, 20 coated sheets were prepared. Then 15 sheets with similar coat weights were selected to test the subsequent coated-paper properties.

The process of coating color preparation was in the following order of addition: pigments (clay and GCC) + distilled water (high-speed mixing) → dispersant (high-speed mixing) → latex binder/lubricant (low-speed mixing) → nanosericite (low-speed mixing) → insolubilizer (low-speed mixing) → NaOH solution (low-speed mixing), pH of the color adjusted to 9.0 → distilled water (low-speed

Table 1. Experimental coating color formulations

Nano-sericite substitution level (part per hundred)	0	0.1	0.2	0.3	0.5	0.7	1.0
Latex level (part per hundred)	11.2	11.1	11.0	10.9	10.7	10.5	10.2

Color formulation: pigments (clay 40 parts + calcium carbonate C90 60 parts) 100 parts, starch 4 parts, lubricant 0.4 parts, insolubilizer 0.45 parts. Solids content: 60%.

mixing). The binder level (latex + starch) was 18 parts based on the dry total pigments.

The coating color was applied to 21.0 × 29.7-cm base sheets using an automatic bar coater (KRK-motor type, Tokyo, Japan). The base sheet was preconditioned for 24 h at 20°C and 65% relative humidity (RH). The coating amount was adjusted by using drawdown bars of different numbers. The coated sheets were immediately placed in an oven maintained at 120°C for 30 s to dry. The coated paper was supercalendered in a double-pass through a single-nip KRK 30FC-200E supercalender with a linear nip pressure of 9.807×10^3 kPa and a temperature of 55°C.

The instruments used for testing the coating colors and coated papers included a Brookfield viscometer using a no. 4 spindle, at 60 rpm (Brookfield Engineering Lab, Middleboro, MA, USA); a Kaltec AA-GWR water retention value meter with 1.5 bar pressure, 120 s, and a 5- μ m filter (Kalamazoo, MI, USA); a Hanna pH meter, model 8521 (Hanna Instrument, Leighton Buzzard, UK); a KRK motor rod-type coater; and a KRK supercalender model 25F-200E. The optical instruments included a Technidyne gloss meter, model T480-A (Edison, NJ, USA); a Technidyne model Micro-5S brightness and opacity meter; a Bekk smoothness tester (Test Machines, Ronkonkoma, NY, USA); and a Parker Print Surf (PPS) roughness tester (Test Machines). The printability instruments included an RI printability tester (Akira Seisakusho, Tokyo, Japan) and an IGT Reptest AIC2-5 printability tester (IGT Testing Systems, Amsterdam, the Netherlands).

RESULTS AND DISCUSSION

Coating color properties

The coating colors were prepared using nanosericite at 0, 0.1, 0.2, 0.3, 0.5, 0.7, and

1.0 parts per hundred of the total pigment by substituting for the binder latex at 11.2 parts per hundred of the total pigments with a corresponding reduction of latex (Table 1). There were 8 experimental sets and 2 sets of replicates for calculating standard deviations. The solids contents of the color were set to 60%, with a range of 59.77~60.47%. The pH values of the colors were adjusted to 9.0 with a resulting range of 9.01~9.12.

Water retention

Effects of adding nanosericite to the water retention property of the coating colors are shown in Fig. 3. The pooled standard deviation of the water retention values (WRVs) was 0.94 g m^{-2} . It should be noted that the WRV is determined by applying a constant load to a color sample and measuring the amount of water expelled. Thus, the higher the WRV numerical value, the poorer the water retention is or less water the color can hold or retain. Figure 3 shows that the WRVs increased with an increasing nanosericite dosage, indicating that the color had decreasing water retention as a result. At nanosericite dosage levels of > 0.2 part per hundred total pigments, WRV increased precipitously, jumping to 73~80 g

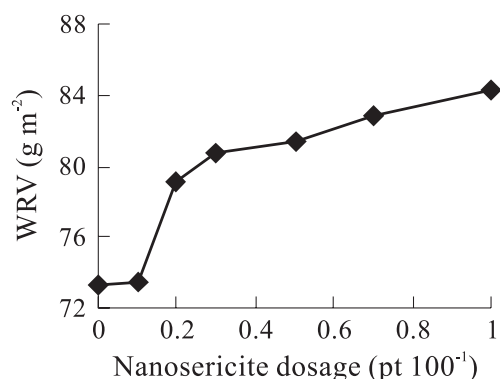


Fig. 3. Effects of the nanosericite dosage on the water retention value (WRV) of the coating color.

m^{-2} and higher. This phenomenon was contrary to the results of Perng et al. (2006a, 2008a) who added micrometer sericite to an LWC formulation, and nanosericite prepared by grinding was added to an LWC color (Lin et al. 2006a, b). A probable explanation was that the intercalated or exfoliated nanosericite had vastly expanded the interlayer spaces over that produced by micrometer sericite and ground nanosericite. Thus, when molecules of water, starch, or latex migrated into the spaces, there was no freshly available storage space to accommodate them, and the retentive performance was achieved. Our observation, however, is congruent with that of Huang and Lepoutre (1998). Thus, when micro-swollen sericite forms a flocculent structure in a mixture of pigment, latex, and water retention agent, and when the bonding forces among the particle aggregates are greater than the internal coalescing forces of individual particles, then the flocculent structure is sturdy, and the water retention of the color is good. Conversely, when the internal coalescing forces of individual particles (in our nanosericite scenario) are greater than the bonding forces among particles, then the flocculent structure is unstable, and the water retention property also decreases.

Low- and high-shear viscosities

The effects of adding nanosericite to the coating color on the low-shear viscosity of the color are shown in Fig. 4 (left). The pooled standard deviation of the low-shear viscosity was 10.1 mPa s. Figure 4 shows that with the addition of nanosericite, the low-shear viscosity of the color increased. It increased precipitously at dosages of > 0.5 parts per hundred of total pigments. This phenomenon was similar to the result when nanosericite prepared by grinding was added to an LWC formulation (Lin et al. 2005,

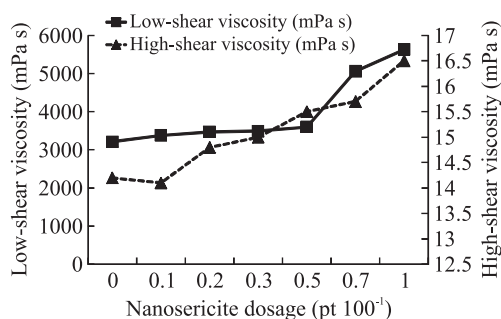


Fig. 4. Effects of nanosericite dosage on the low-shear viscosity (60 rpm, left) and the high-shear viscosity (at 8,800 rpm, right) of the coating color.

2006). When micrometer-scale sericite was added, however, although the low-shear viscosity increased, the upswing was nowhere near as great (Perng et al. 2006a, b, 2008a). This illustrates that the mechanisms between the low-shear viscosity increases in the 2 cases probably differed. The mechanism for micrometer sericite appears to be imbibing water and polymer molecules such as starch and latex into the swollen interlayer spaces through capillary or concentration gradient effects. The effective spaces available were limited, and the resulting increase in the low-shear viscosity was moderate (Perng et al. 2006a, b, 2008a). In the case of nanosericite, however, the mechanism possibly entailed the nanoparticles serving as seeds of nucleation and allowing macromolecules such as starch and latex to form clusters with pigments (clay and calcium carbonate). The free water in the system was then probably entrained by the clusters and became bonded. Loss of free water in the color then resulted in an increase in the low-shear viscosity (Aidun et al. 1993, Nygard 2008). At a dosage of 0.5 parts per hundred of total pigments, the low-shear viscosity increased from 3600 to 5060 mPa s, indicating that the nucleation effect of the nanosericite had exceeded the limit, causing

a drastic increase in the low-shear viscosity of the color. In addition, comparing the results of adding nanosericite by grinding and hot NaOH solution methods, the former had an average particle size of 102 nm and the latter 30 nm. Thus, the nominal numbers of nanosericite particles at the same dosages differed by 39-fold, and the resulting low-shear viscosity increases notably differed, with the former showing a lower degree of increase as there were much fewer nucleation sites.

The effects of adding nanosericite to the high-shear (at 8800 rpm) viscosity are shown in Fig. 4 (right). The pooled standard deviation of high-shear viscosity was 0.45 mPa s. The figure shows that the high-shear viscosity of the color also increased with an increasing nanosericite dosage, similar to those of the low-shear ones. The high-shear viscosities of the color ranged 14.1~16.5 mPa s, which was still within the operational range of the coater. The modification of high-shear viscosity due to nanosericite addition fundamentally differed from that of adding micrometer sericite as observed in our earlier studies (Perng et al. 2006a, b, 2008a). This indirectly illustrated that in low-shear viscosity determinations, the increase in color viscosity with micrometer sericite addition was due to adsorption of water and polymer onto the interlayer spaces in the micrometer sericite, and the reduction in bulk water caused a thicker and more-viscous color medium. However, under high-shear conditions, the interlayer space tended to be compressed by the shearing force; and water and polymers were thus transported into the slurry medium, leading to decreased viscosity. Conversely, with nanosericite addition, the clustering caused by nucleating around pigment particles presented a quasi-stable structure that resisted shear compression without releasing bonded water, so the viscosity tended to increase.

Triantafillopoulos (2010) described a coating development that by making SBR binder particles smaller (~70 nm), it worked better with a trend toward thinner platy pigments and engineered pigment sizes of a controlled population and engineered precipitated calcium carbonate (i.e., nano-pigments). When ordinary high-performance latex binders with a particle size distribution of 120~210 nm were used, both low- and high-shear viscosities tended to increase excessively, and the high viscosity in turn required an increased coater blade pressure, and there was the potential for poorer binder distribution and coating quality. Thus, it appears that a concurrent reduction in the binder particle size to the nanometer scale might be a viable means of solving the viscosity spike.

Coated paper properties

There were 10 experimental sets (including 2 replications), and each set contained 15 coated sheets with similar coat weights of 8.5 g m⁻² that were used for property assessments. The pooled standard deviation of the coat weight was 0.18 g m⁻².

Opacity

Figure 5 shows the effects of nanosericite addition to the coating color on the opacity of the resulting paper. The pooled standard deviation of the opacity measurements was 0.18%. The figure shows that at < 0.5 parts per hundred of total pigments, there was no distinctive opacity effect. At dosages > 0.5 parts per hundred of total pigments, however, the opacity of the coated paper increased from 81.5 to 82.2%. Conversely, Lin et al. (2005, 2006) found that the addition of nanosericite prepared by grinding the resulting coated paper had decreased opacity. Nano-scale pigments with sizes of less than 1/2 of the visible light wavelength, should appear transparent,

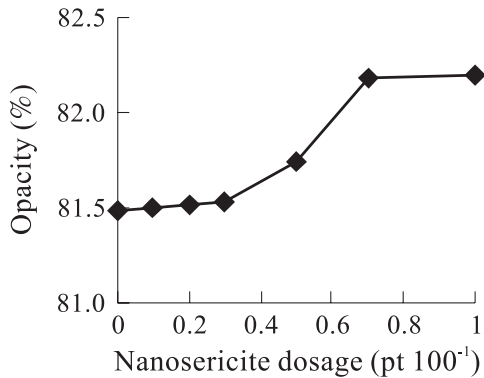


Fig. 5. Effects of adding nanosericite to the coating color on the opacity of the resulting paper.

hence their addition should tend to reduce the opacity (the reversal of transparency). The increase in opacity in our case thus might have resulted from the clustering effect of its addition which created aggregates that could increase light scattering or opacity. Incorporating micrometer sericite to the coating color, however, always increased the opacity of the coated paper (Perng et al. 2006a, b, 2008a).

Brightness and whiteness

Effects of nanosericite addition to the coating color on the brightness of the result-

ing paper are shown in Fig. 6. The pooled standard deviation of brightness measurements was 0.12% ISO. The figure shows that paper brightness increased with an increasing nanosericite dosage and exhibited a linear relationship. The brightness value increased from 70.2 to 71.3% ISO with only 1 part per hundred nanosericite addition. This trend is in contrast to cases of micrometer sericite coating formulations (Perng 2006a, b, 2008a). The lower intrinsic brightness of the pigment tended to adversely affect the brightness of the finished paper. The results indicated that hot NaOH solution treatment caused effective intercalation and subsequent exfoliation, leading to a colorless, transparent preparation that tended to enhance the brightness of the paper.

Adding nanosericite to the coating color caused a modifying effect on the whiteness of the resulting coated paper as also shown in Fig. 6. The pooled standard deviation of the whiteness measurements was 0.29% ISO. The whiteness tended to increase with increasing nanosericite in the color up to 0.5 parts per hundred, reaching 73.9% ISO. Further increases in the dosage caused a decreasing trend, however. Since whiteness includes the perception of the blue fluorescent component,

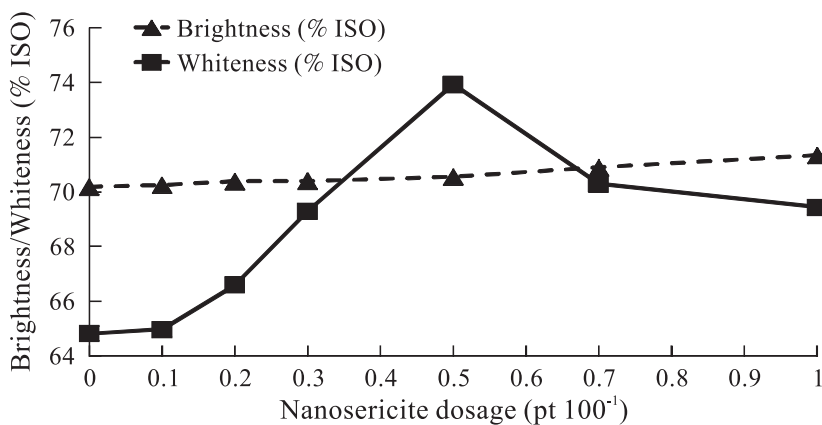


Fig. 6. Effects of adding nanosericite to the coating color on the brightness and whiteness of the coated paper.

which the brightness specifically excludes, the dip in whiteness might have been caused by abatement of fluorescent emission through internal UV absorption of the nanosericite at higher levels.

L*a*b* values

CIE L*a*b* measurements are more refined than brightness and whiteness in that they provide information on color tones in addition to luminosity. The effects of adding nanosericite to the coating color on the L*a*b* values of the resulting paper are shown in Fig. 7. The pooled standard deviations of L*, a*, and b* values were respectively 0.26, 0.09, and 0.08.

Figure 7a shows that changes in L* of the coated paper with nanosericite addition to the coating color closely paralleled those of whiteness measurements. The value increased with an increasing nanosericite dosage to the 0.5 part per hundred level and reached a maximum of 88.3, then a further increase in dosage caused L* values to decrease.

Figure 7b shows changes in a* values of the coated papers when the coating color contained varying amounts of nanosericite. a* represents tonal variation along the green (-) and red (+) axis. Adding nanosericite turned the tone of coated paper from green to red. With an increasing dosage, a* values also

increased; at a nanosericite level of 0.2 parts per hundred, the tone changed from greenish to reddish.

Figure 7c shows changes in b* values of the coated papers with changing levels of nanosericite in the coating color. b* represents the blue (-) to yellow (+) tonal axis. Adding nanosericite caused the coated paper tone to shift from yellowish to bluish. The more nanosericite that was in the color, the lower the b* value became. At dosages of > 0.3 parts per hundred total pigments, a stable tone was reached. Since ISO brightness defines paper brightness as reflectance of blue light at 457 nm, the bluish tone of the coated paper incorporating nanosericite might thus have contributed to the consistent brightness increase with higher dosages observed above. As the coated paper is already bluish, no blue dye or pigment is needed to adjust the tone for a brighter appearance.

Bekk smoothness and PPS roughness

Figure 8 shows the effects of adding nanosericite to the coating color on the surface smoothness of the resulting papers (left). The smoothness measurements had a pooled standard deviation of 1.8 s. Changes in paper smoothness as determined by a gas-leak (Bekk) method included an initial decrease at nanosericite dosages of 0.1 and 0.2 parts

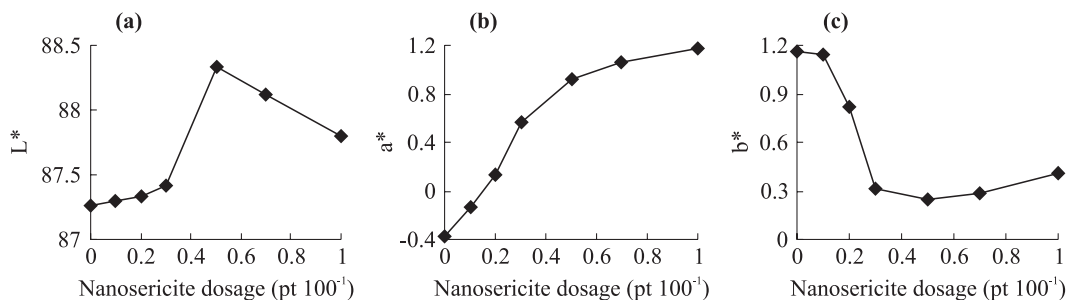


Fig. 7. Effects of nanosericite dosage in the coating color on the (a) L*, (b) a*, and (c) b* values of the coated paper.

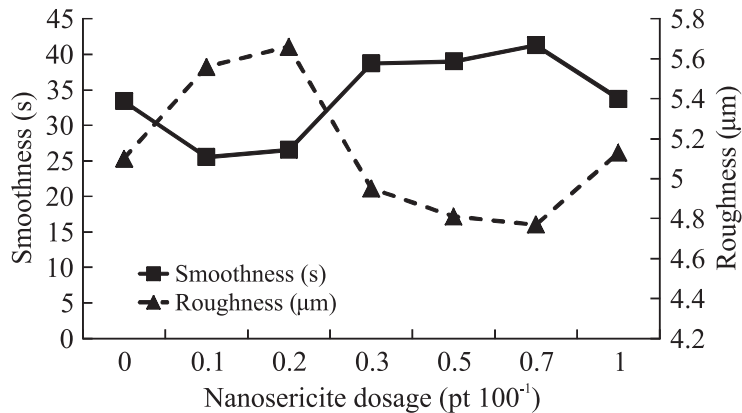


Fig. 8. Effects of adding nanosericite to coating color on the Bekk smoothness (left) and the PPS roughness (right) of the resulting coated papers.

per hundred total pigments; then at dosages of > 0.3 parts per hundred total pigments, the smoothness increased; and finally at 1.0 parts per hundred total pigment, the value decreased again. Compared to the results of Lin et al. (2005, 2006) who used ground nanosericite, the paper smoothness consistently increased with an increasing sericite dosage. In cases of coating formulations containing micrometer-scale sericite, however, the smoothness of the coated paper tended to decrease with an increasing sericite dosage (Perng 2006a, b, 2008a). Both above cases can be explained on the bases of pigment particle sizes. In the case of hot NaOH solution-treated nanosericite, however, the mineral plates were exfoliated with large voids which were filled by the color ingredients. Nucleation of the binder and pigment particles clustering around the nanoparticles might have contributed to the decreasing smoothness at both low and high levels of addition.

The effects of adding nanosericite to the coating color on the PPS roughness of the resulting papers are shown in Fig. 8 (right). Although the PPS instrument also uses a gas-leak principle, it converts the reading to a roughness scale expressed in the surface

contour in micrometers (μm). As a parameter, roughness is increasingly used as a quality indicator in coated paper printing. Interestingly, the roughness results were an inverted image of the smoothness ones. Hence, the surface characteristics of the 2 measuring techniques essentially conveyed the same trend.

Unprinted and printed gloss

Gloss values of coated papers incorporating nanosericite both before and after printing are shown in Fig. 9. The pooled standard deviations of the unprinted and printed gloss were respectively 0.52 and 0.53%. The range of values for the unprinted paper was 15.5–15.7%, the spread was within the experimental error, and it appeared that adding nanosericite had no effect on the coated paper gloss. Printed gloss of the coated papers, however, increased with an increasing dosage of nanosericite in the coating color. The platy nature of nanosericite probably enhanced the printing performance. Coating color formulations containing nanosericite thus can be considered for use in the matt grade of coated papers. In our micrometer-scale sericite coating studies, both the unprinted and printed gloss tended to decrease with an increasing sericite

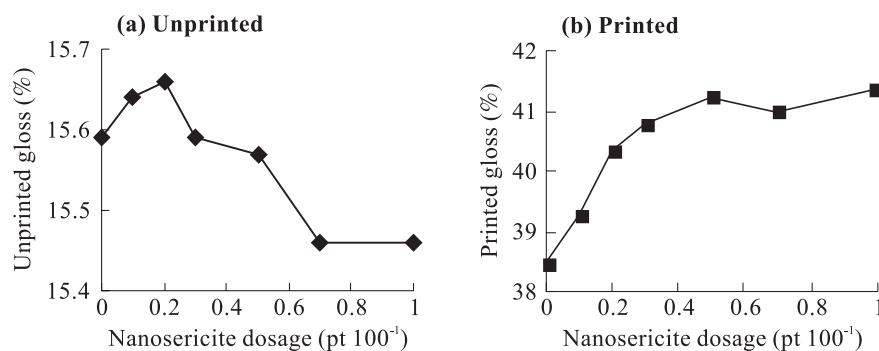


Fig. 9. Effects of the nanosericite dosage in the coating color on the (a) unprinted and (b) printed gloss of coated papers.

dosage (Perng et al. 2006a, b, 2008a). In Lin et al.'s (2005, 2006) studies, they noted that both unprinted and printed gloss increased with an increasing ground nanosericite dosage.

RI dry- and wet-peeling strengths

All experimental sets produced an RI dry-peeling strength of 2.4 units, and an RI wet-peeling strength of 3.8 units (data source not shown due to a lack of variability). Incorporating nanosericite into the color thus did not affect the surface binding strengths of the coated papers. This bodes well for using nanosericite as a functional co-binder in coating formulations. In Lin et al.'s (2005, 2006) studies, however, they noted that adding ground nanosericite to the coating color tended to decrease both the dry- and wet-peeling strengths of the coat layer.

CONCLUSIONS

The purpose of this study was to examine characteristics of coating colors containing hot NaOH solution-intercalated nanosericite which was substituted for equivalent amounts of SBR latex binder and to evaluate papers coated with the colors. For the coating colors, the addition of sericite decreased their

water holding capacity while increasing both the low- and high-shear viscosities. The colors were still within the operational range of the coater despite the changes. As for coated papers, the optical properties of the coated paper such as opacity and brightness tended to improve with nanosericite addition; the tint of the coated paper also shifted from green and yellow to red and blue. As to the surface properties, nanosericite generally increased the smoothness and reduced the roughness, however, at both lower and the highest dosages, the trends were reversed. The unprinted gloss of the coated paper was largely unaffected by adding nanosericite; however, the printed gloss tended to improve with the inclusion of nanosericite. Inclusion of nanosericite to replace a portion of the latex binder did not appear to affect the binding strengths of the coat layer as indicated by the invariant RI dry- and wet-peeling results. Modification of coating color rheological properties by adding such minute amounts of nanosericite also warrants a further look to explore its capacity as a rheological adjusting agent of coating colors.

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