

Point of Sale Tinting Systems – the 6th Decade of Use A User's Perspective

Some time ago I handled a query from an Architect which required a very complex and unusual set of coating parameters to solve a particular problem. Proudly, I was able to detail a brand new coating just out of the development laboratory, which fitted the bill precisely. Instead of being overawed by our technical brilliance, he asked whether it was available in 'Hot Purple'? Being a development product, it wasn't, and the Architect settled on a product which required substantial technical compromise but was available in the colour of his choice.

This story outlines the importance of colour in the buying or specifying decision particularly in a society that is somewhat spoilt for choice. Collectively the New Zealand paint industry offers formally about 12,000 different shades (and informally any shade that a customer requires). It was not always like this however and in the past, apart from a few trim colours, the antithesis of Henry Ford's policy existed - "Any colour as long as it was white - or off white!" The advent of 'universal' tinters was the key to the colour revolution, and they changed the face of the New Zealand Paint Industry.

The early days

'Universal' tinters, meaning tinters that are able to be used both in waterborne and solvent-borne decorative paint finishes, were developed in the U.S.A. in the 1950's. The concept was, and still is, that by using a small range of tint bases containing varying levels of factory dispersed pigment, a total range of colours could be produced by adding a known recipe of tinters. It is the salesperson's and accountant's dream, and the technologist's nightmare.

The ability to instantly produce an infinite number of colours, and never be out of stock has obvious attractions for the salesperson, and the ability to do so without carrying a huge number of stock units appeals to the accountant. The technical truth is, however, that 'universal' tinters contain large amounts of excipients (water, glycols/humectants, surfactants) that can be deleterious to the base paint.

The Resene experience

In the late 1960s our company introduced a point of sale tinting system based on such an early American tint system which, contained excellent inorganic dispersions but weaker organic ones. We celebrated the introduction of the system by also introducing to New Zealand the British Standard 2660 **(3)** colour chart and, to complete the package, we took the decision to become lead free. The architects loved the new, bright colours offered by the B.S. colour range, but the bright yellow 0-001; based on a 20% addition of a weak Hansa Yellow tinter to an almost neutral base; did not cover well, had poor flow characteristics; took days to dry; and, if the humidity and temperature balance was such, could dry into a perfectly flat finish, went down like a lead balloon with the painting fraternity. It was clear that the painters in New Zealand were not prepared to accept quality compromises for the convenience of having a tinting system. This

dilemma of setting quality is still in existence today, and the Achilles heel of most tinting systems is the inability to produce deep, bright colours with adequate covering power.

The Resene approach

The valid approach of using two sets of tinters for solvent and waterborne and decorative coatings, was not open to us, and consequently we adopted the strategy of trying to reduce tinter levels at all times. Whilst it is theoretically possible to produce every known colour from a neutral base and a range of tinters, the quality limitations of such an approach are obvious, as are the commercial benefits to the tinter supplier.

Our approach was, in fact, to increase the number of titanium dioxide containing bases and to also introduce a range of coloured bases. For example, in the area of bright yellows, we produced a base utilising nickel titanate yellow and pigment yellow 1, (later to be replaced by pigment yellow 74). Nickel titanate yellow proved to be an ideal pigment for a base to be tinted as it had a very low tint strength but excellent hiding power. In 1970 this was a pretty novel approach.

We also produced a range of fully tinted undercoats.

These moves went some way to remedying the hiding strength problems but there were still shortcomings. In 1973 we became aware of a range of universal colourants which were designed only for in-plant tinting, but which were exceptionally high strength. Indeed, some of the organic pastes were up to four times the strength of the traditional pastes being offered. This allowed a significant breakthrough and the hiding of deep colours to truly approach the standard, high quality, dry ground analogues.

The influence of shelf space

Our company has the luxury of owning our own single brand ColorShops, which do not demur from stocking the many coloured bases in our system. More typically, constraints on shelf space push paint manufacturers competing for this space to have fewer bases within their system, often as low as two. We have designed such systems for colleagues in the Asia-Pacific area, but the compromise on quality is significant. Although the inclusion of a white tinter in the system does in fact allow an infinite number of white bases, costs and excipient-induced weaknesses are heavy prices to pay.

Problem areas

High strength tinters can be used to solve many of the hiding/quality problems associated with tinting systems, but they do have two weaknesses. One is in the production of pale colours in small sizes, particularly in markets that have low levels of titanium in their white. The inclusion of some deliberately weak shading tinters was one solution that was used to overcome this. However, the ever increasing precision of delivery equipment is also solving the problem.

The second and most frustrating and persistent problem, exacerbated by high strength tinters, is poor tinter compatibility. I use the word 'compatibility' with a certain amount of trepidation as it does not accurately describe all the nuances of the intermixing of concentrated tinter pastes into systems.

A model system

A simple and idealised model for universal tinters would be as follows: First firmly anchor a monomolecular layer of material onto the pigment surface which presents a hydrophobic orientation away from the pigment: Double layer this with a simple hydrophilic/hydrophobic structure which would convert the pigment particles to a hydrophilic surface: carry these particles in a water/glycol blend.

In a waterborne system these would diffuse and disperse spontaneously throughout the system.

In a solvent borne system, the water and glycol would nucleate micelles which could peel off the outer layer of surfactant, revealing a compatible, hydrophobic layer on the pigment, and an equally compatible hydrophilic centred micelle surrounded by an outwardly looking hydrophobic layer.

So much for fairy tales.

Studies introducing drops of colourant into various media shows that there is almost no spontaneous diffusion in anything other than water and a few, simple, water surfactant systems. Polymers, thickeners, surfactants, rarely ever set up simple solutions, but a complex of domains. Indeed, associative thickeners are designed to promote such domains.

In my experience, tinters find their way to the places in the paint system where they are most comfortable, and that this is the cause of much of the poor compatibility/colour development/tint acceptance/rub up which continues to frustrate us. The most dramatic example I ever saw was in a highly structured urethane-acrylic system designed for high build, airless spray application. It was tinted to a light grey, and produced a uniform colour on application. When the applicator's airless spray gun broke down, he reverted to air assisted spray, thinning the product with the correct thinner which brought about the appearance of black pigmented droplets in a very pale grey continuum. The pigment friendly domains had obviously been finely dispersed through the coating and held in place by high structure. Release of this structure by thinning allowed these domains to coalesce into the visible black droplets.

Factors affecting colourant compatibility

Colourant compatibility is impacted by all elements of the system. The continuous medium has probably the most significant impact but these can be subtly affected by the dispersed phase. Identical paints varying only in the type of titanium used, can show dramatic differences in tinter acceptance. One can only assume that the orientation of the first layers of material on the titanium surface provide some form of template for subsequent associations.

Time can be a wonderful ally in solving these problems. Evaluating one particular alkyd, I have seen the worst tinter acceptance performance in my experience, turn into the best in my experience, simply by ageing the untinted base paint three months. In this case I

felt sure that a substantial high molecular weight fraction in the rather poorly made alkyd was problematic initially, but that this fraction eventually ended up on the surface of the titanium and completely changed the nature of the continuous phase. Indeed, the presence of a large amount of low molecular weight fraction could have been beneficial in this configuration.

Although time is normally an ally we have also experience where the reverse has occurred. At its most embarrassing, a tinted batch of paint was supplied and half of the 400 litre order was applied satisfactorily and produced the correct colour. The application of the second coat was inadvertently delayed by about four weeks, during which time, due to selective flocculation of the titanium, the colour was totally different.

Selective flocculation is an unusual phenomena. We have even seen it in a minor pigment component during a typical rub up test.

I started this section referring to the fact that to me the process of incorporation of the tinter into the paint system is shrouded in mystery. Of late, there has been significant attention given to this area by the 'additive' suppliers and many new products have become available claiming to be panaceas. In my opinion, because the basic phenomenon has not been fully elucidated, the panaceas in fact become 'spot' fixes with success in some formulations only.

Colour as a marketing tool

It is interesting to note the marketing potential of colour that tinting systems bring, and yet the architectural paint market has been very slow to adopt colour as a point of difference. Even though the American market has led with the "Walls of colour" concept, the colour offerings have generally been the same from supplier to supplier. It is only recently that differentiating colour offerings such as those endorsed by Ralph Lauren and Martha Stewart have been used to differentiate different paint companies.

The presence of a successful standard, such as the British Standard 5252 can mitigate against individual paint company's exploitation of colour.

South Korea has a single fandek which is produced by a Paint Manufacturers Association, and all companies use it. To the best of my knowledge there are no individual colour cards at all in that country.

In summary

We believe colour can be a successful point of difference between paint companies, and we attempt to bring out a new range regularly. We also include within the range, anything which may be fashionable, be it paint effects, metallics, or pearlescents. The colour offering gets backed up with testpots, self adhesive colour chips, A4 drawdowns and electronic representations. Colour renderings are offered, as are virtual painting schemes, and the ability for users to generate their own colours using the RGB values on a screen and convert that to a paint colour.

There is virtually no product that we make which is not designed to bolt on to our tinter system, to instantly provide our full colour library in that product. New specialised tinters get added for new finishes, such as transparent iron oxides for our wood stain range, thermally reflective pigments and an increasing number of high performance organic reds and oranges.

The full colour range is offered in a high performance range of coatings, and the requirements of the market are such that any difference in colour standard expectations between a purely decorative and a high performance coating have long since disappeared.

The future

As for the future, the demise of universal colourants will parallel the swing to all waterborne technologies. However, as this swing is happening at vastly different rates throughout the world, the universal colourants are likely to be around a long time yet. Some of the major pigment houses however are signalling their readiness for this change by expanding their traditional ranges of pastes offered for waterborne paints and by offering them calibrated volumetrically. We ourselves have designed tinting systems on such products for some colleagues in the Asia Pacific area who only have a waterborne product range.

I believe that the major thrust for the future will be tinting pastes with excipients, which have a secondary useful role in the coating.

The major advances in compatibility improvement will only ensue when the pigment surfaces are fully stabilised with a tenaciously adhering surfactant system. Pigment manufacturers have been noticeably reticent in providing clear characterisations of their pigment surfaces. Without such knowledge dispersing/stabilising systems will invariably be haphazard and lacking precision, and the excessive use of surfactants will continue to be both an economic and technical weakness.