GREAT-LOOKING THANKS TO INTERFERENCE PIGMENTS

The first interference pigments were only used for automotive styling. Today, they are an indispensable part of the automotive industry and OEM finishes containing them come in all colours. By Werner Rudolf Cramer.

Interference pigments were initially offered by automotive paint makers for styling vehicles. They made the breakthrough into OEM finishes in 1985 when Renault and Volvo each pioneered models in Pearl White. Originally applied in a 3-layer system comprising white basecoat, pearl white interference coat, and clear coat, it was not long before they were combined with coloured pigments that quickly conquered the market. In the mid-1990s, blues and greens were especially popular. Since then, blends with coloured, aluminium and interference pigments have come to dominate. These are usually 2-coat systems; a tendency towards coloured clearcoats is emerging, however.

Looking back, 1969 can be regarded as the dawning of a new pigment era. This was when DuPont entered into a cross-licensing agreement with both Mearl and Merck, both of which adopted DuPont's production process and some of the designations and names that it had been using for its interference pigments. These pigments are derived from natural mica flakes, which are coated with highly refractive metal oxides, such as those of titanium and iron. When light strikes the surface, a portion of it is reflected and a portion is refracted through the metal oxide layer. At the next boundary layer, some more light is reflected and it exits the pigment surface parallel with the first reflected portion. As the path lengths of these two light portions differ, the light waves are displaced relative to each other. These interfere, producing a mixture of strong and weak waves.

Interference pigments have two particular characteristics. First, the perceived colour varies with the angle of the incident light. Second, they work on the principle of additive mixing. Thus, a mixture of pearl yellow and pearl blue does not appear green, but instead is white. Details of how to measure the colours and the effects are contained in the "Standard Test Method for Multiangle Colour Measurement of Interference Pigments" (ASTM E2539), issued in 2008. This recommends the use of two different angles of illumination, and taking readings on either side of the specular angle. For physically plausible measurement and representation of the interference pigments, an arrangement of three illumination angles and the same aspecular angle from the respective specular is advisable. The aspecular angle in this case should be smaller than 20°.

The colours of the interference pigments based on natural or synthetic mica range from silvery-white to yellow, red, green and finally to blue. The resulting primary colour depends on the thickness of the layer of titanium dioxide. Pigments coated with iron oxide pigments are red to reddish-violet while combinations of titanium dioxide and iron oxide are golden. Other carrier materials – as described below – produce similar colour reactions, but yield different effects.

Ongoing development work on interference pigments has spawned fascinating, new types. Aside from the original pigments based on natural and synthetic mica, several manufacturers offer pigments supported by other carrier materials, such as silica and alumina. Both of these materials are transparent and are also coated with titanium dioxide or iron oxide. Silica as carrier material yields pigments which have large colour travel, which means they undergo a marked col-

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Kuncai		CQV		BASF		Merck		Eckart	
Pigment group	**Name**	**Pigment group**	**Name**	**Pigment group**	**Name**	**Pigment group**	**Name**	**Pigment group**	**Name**
XillaMaya	Crystal Silver	Adamas	Splendor White	Paliocrom®	Bright Orange	Iriodin	Pearl Gold	Symic OEM	Medium Silver
XillaMaya	Galaxy Blue	Adamas	Splendor Blue	Paliocrom®	Bright Gold	Xirallic	Crystal Silver	Symic OEM	Medium Copper
XillaMaya	Electric Blue	Adamas	Dazzling Red	Mearlin Exterior	Fine Red	Colorstream	Viola Fantasy	Luxan CFX	Red
Setallic	Desert Orange	Kromax	Corona Violet	Mearlin Exterior	Aztec Gold	Pyrisma	Liquid Blue		
Automotive	Rutile Green Pearl	Automotive	Splendor Red	Glacier	Ext. Frost White	Meoxal	Wahiba Orange		

Source: Werner Rudolf Cramer

10 million tonnes of inorganic pigments are expected to be sold annually by 2020.

HOW TO EFFICIENTLY CHARACTERIZE SPECIAL EFFECT COATINGS

In this paper, a simple and efficient approach is presented on how to characterize the appearance of surfaces composed of metallic and interference pigments.

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our change, for example, from green to yellow to violet. Alumina as carrier material produces a phenomenon known as sparkle in addition to the colour effect.

Coated aluminium flakes also count as interference pigments. Currently, several are offered in colours ranging from gold to red, with a slight colour change. Interference pigments produced in high vacuum also exhibit extensive colour travel across several colour quadrants. As they are very expensive, they are little used in OEM finishing. Paint makers tend to offer them as specialist and styling refinishes.

COLOUR MEASUREMENT OF INTERFERENCE PIGMENTS

The colour travel produced by interference becomes evident when the angle of incidence is changed. In this example, the angle of incidence varies from steep (20°) to classic (45°) to flat (65°). The aspecular angle in each case is a constant 15°.

The aspecular curve shows the readings obtained under constant illumination at an angle of less than 45° and a modified aspecular angle. The latest portable instruments also offer this capability.

	Schlenk		Viavi Solutions (Flex Products)	
	Pigment group	Name	Pigment group	Name
	Multiflect	Polychromatic	ChromaFlair	Green/Purple 190
			SpectraFlair	Silver 1500