

## Editorial

### True Colour: What Does it Mean for Holography

It's been a long time coming, but there is a real feeling that effective and commercial true colour holography is about to make its mark on the holography markets. The level of colour saturation, efficiency and resolution achieved by Laboratoire d'Holographie (see p 13) with hand-made emulsions gives the producers of low-cost mass-produced colour holograms something to aim for. The Gentet brothers have raised expectations in colour holography, but having shown what can be achieved, the resources of DuPont, Dai Nippon and others will now have to be focused on delivering that quality in mass-production.

It is difficult to predict the impact on the markets of this quality of full parallax, true colour holograms; but impact there will be. In a world where image is all important and leading brands pay hundreds of thousands of dollars to develop their logos and their designers specify inks from a palette of thousands of Pantone colours – colour is important. Brands want colour and they want *their* colour, not an approximation. The public wants colour. They want 3D as well, and both are now available to them: true colour, 3D and full parallax.

Lighting will remain an issue. Zebra is selling its new reflection holograms with an integral light arm. Dai Nippon's mass-produced holograms and Laboratoire's handmade silver halide holograms are

visible in ambient light but improve no end under halogen spotlights. What has happened to the research on optical waveguides and internal illumination for holograms? Maybe this is what is needed to realise the market potential of the colour holograms.

We can't say how quickly the markets for full colour reflection holograms will grow, but grow they will. So for the first time in two decades embossed holography is likely to be joined in the mass markets by a different type of hologram. Embossed stereograms and pixellated transmission holograms can give approximately correct colours at specific viewing angles, but (so far) only reflection holograms can reproduce accurate shades through wide vertical and horizontal viewing zones. So reflection holograms are going to become more familiar in the markets.

And let's acknowledge the role played by DuPont in all this. All the companies producing full colour holograms use DuPont photopolymer or otherwise recognise that this is the medium for mass production. DuPont has been involved in holography for over 20 years; it has seen Ilford and Agfa pull out, but has stayed committed, with a strong R&D programme that is now delivering a panchromatic, high resolution material for holograms. It now seems that they will get the reward for their perseverance and the 'ultimate' holograms will shortly be commonplace.

### Truly Colourful Holograms from France

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In 1997, Holography News reported on the silver halide colour holograms being produced by the Laboratoire d'Holographie in Bordeaux, France (see HN Vol 11 No 8/9); the two brothers who run the Lab, Yves and Philippe Gentet, have continued to make progress. At Holography 2000, they proved that seeing is believing as 140 seasoned holographers made a collective, awed, intake of breath when the Gentet's showed their colour holograms; an effective demonstration of their characteristics of colour saturation in high resolution reflection holograms to a degree never seen before. The colour saturation of their Denisyuk holograms is comparable with photographic prints, and the image plane holograms match this degree of saturation but lack the impression of solidity that can only be seen in Denisyuk holograms.

The Gentets have devised their own-formulation silver halide emulsion to achieve this quality, which they call – without hyperbole – the *Ultimate Emulsion*. This emulsion has ultra-fine grains of 10 nm, giving a resolution of 10,000 lines/mm and high sensitivity. It is prepared in three different types, optimised respectively for three-colour continuous-wave laser exposed reflection holograms, for pulse laser reflection holograms and for colour transmission holograms. The Gentets mix their emulsion in a gelatin base and coat film and glass each day for their requirements. They have also designed a machine to

coat triacetate film up to 36 x 44 cm and glass plates up to 60 x 84 cm.

For colour reflection holograms the Gentets use argon (476 nm), Yag (532 nm) and HeNe (633 nm) lasers. The sensitivity of the emulsion means relatively short exposure times: they quote 20 seconds for a 30 x 40 cm three-colour Denisyuk hologram with the 20mW HeNe the lowest power of the lasers.

After showing their holograms every holographer present wanted a sample of the Ultimate Emulsion. But the Gentets do not plan to move into commercial production, and recognise that the formulation might not lend itself to scaling up (Yves told Holography News that mixing it is like being a chef!). They envisage it as an ideal medium on which to master full colour holograms for copying into photopolymer for mass production in full colour. They have demonstrated the material to DuPont which has tested the holograms as masters for replication, and at Holography 2000 representatives from Dai Nippon also discussed this with them.

Meanwhile, they continue to produce limited runs of colour and pulse holograms for clients and limited-edition sale.

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