MAN OF FIRE
RESEARCH AND DEVELOPMENT

Intumescent History & Technology Change

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Introduction

There are a lot of extremely high specification products on the market for Passive Fire Protection coatings in these modern times, but unfortunately the same base technologies have remained unchanged now for nearly 60 years.

As an industry we still look to mineral/steel powders (APP's) that are physically carved from the surface of our planet leaving scars the size of small cities which traditionally need to melt to a point of activation, typically 200-300°C, or, 392-572°F.

At a time where the protection from fire for both our populations and our structures/infrastructures has come to the forefront of our design scopes for nearly all things now, we are also learning that we simply cannot continue to destroy the planet we inhabit without consequential effects.

It therefore stands that to look into the future of Passive Fire Protection Coatings we need to look back and learn from the mistakes of the past.

What if, instead of mining out minerals and destroying our living space, we could use Recovered Carbon Dioxide caused by pollution to aid a chemical revolution in a bespoke reactor to create a liquid form addition formula that would replace the need to mine APP's at all?

Imagine then if that liquid could outperform powders by approximately 15:1 in terms of application timings and curing, and specifically engineered fire performance.

What if, that Liquid Flame Retardant (LFR) could be used across all industries using Passive Fire Protection Coatings and Technologies to completely revolutionise the way we think about how to improve on Fire Performance?

What if, it could be blended into nearly all synthetic materials including Carbon Fibre and Composites to make them physically fireproof without the need for a coating at all?

We will visit this later but for now, where did intumescent coatings begin?

Timber Fire Protection

World War II has just ended, and an aircraft is recovered from a crash site discovered to be of German origin.

Following its removal from the crash site and forensic investigation into its properties and structure there was evidence that pointed towards an early green fireproof paint based on polyvinyl chloride that was developed in Germany during 1945.

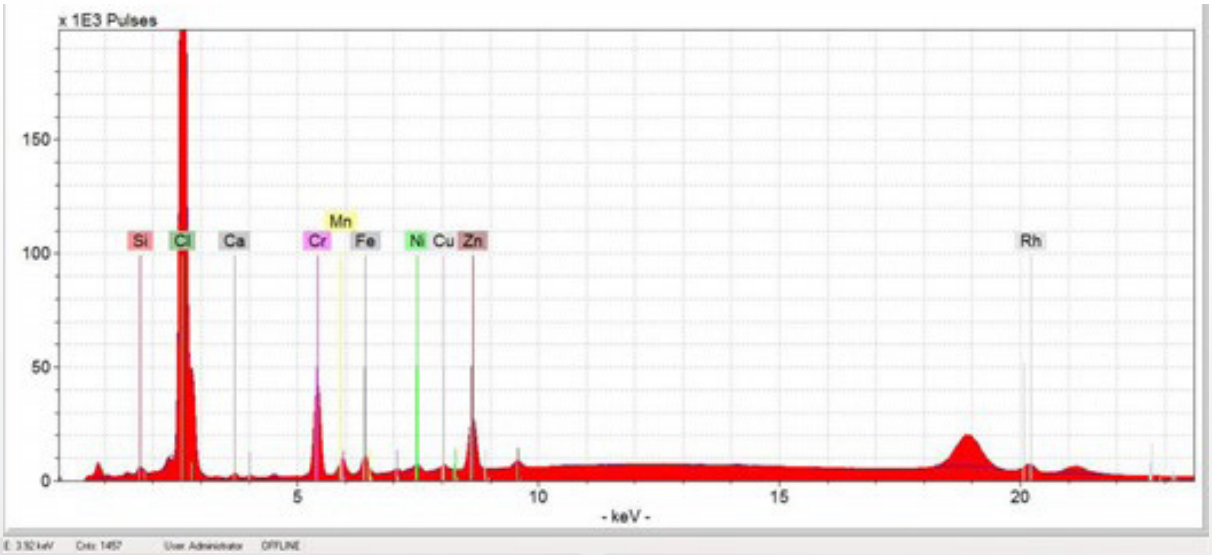
Some say this was the first discovery of a "fireproof" paint.

Research into common coatings for aircraft plywood on the crashed Horton HO 229 V3 indicated a strong prevalence of the use of nitrocellulose and phenol formaldehyde varnishes with red iron oxide pigments. *(Merrick and Kiroff 2004; and Palmer, G., Macmaster, A., Hughes, H. 1945).*

The tail of the Horten Ho 229 V3 showing the presence a green paint on the exterior of the aircraft. This area of green paint was revealed once the steel exhaust fairing was removed for treatment. *Image: Anna Weiss*

When it became obvious both visually and chemically that this coating was atypical, additional research uncovered evidence that an early green fireproof paint based on polyvinyl chloride was developed in Germany during 1945. A Gotha glider is reported to have been painted with a green fireproof product composed of cellulose acetate and polyvinyl chloride.

This paint was supplied under the general trade name "Herbolid" and contained a PVC-based additive called "Vinoflex" (Merrick and Kiroff 2004). According to subjects of a post WWII interrogation, "the stability of this resin depended on after-chlorination being pushed as far as it would go to give a product 60 to 66% total chlorine."

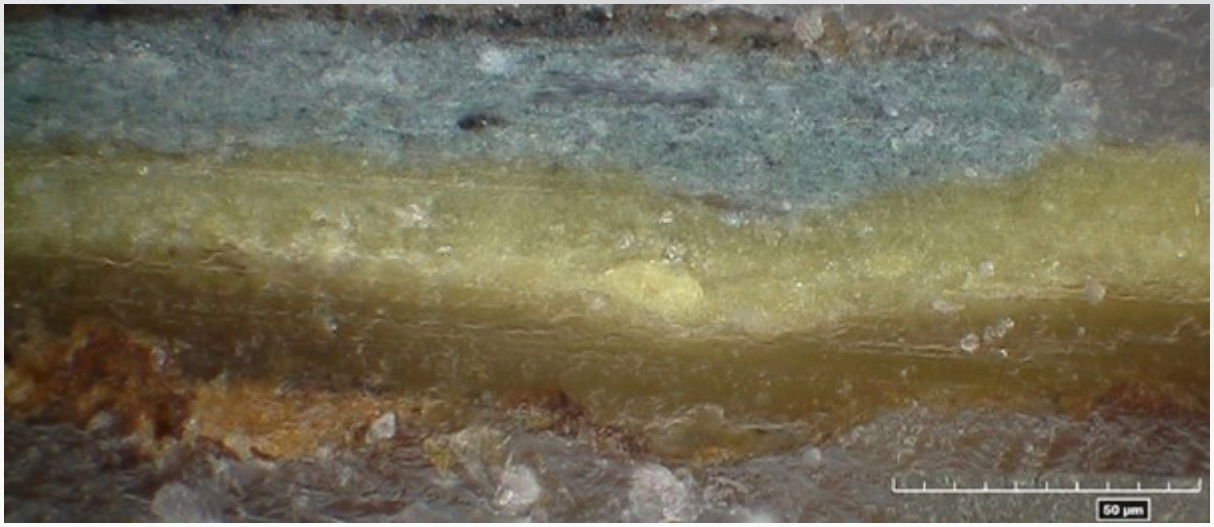


XRF spectrum of a green paint sample showing elements of chlorine, chromium, zinc, and some iron. *Spectrum: Lauren Horelick, 2014*

The same interrogation indicated that, "[its] fireproofing properties on wood, where the weight ratio P.V.C/cellulose was very low" *(Kline, G.M. 1945, and Jackson, C. M. 1946).*

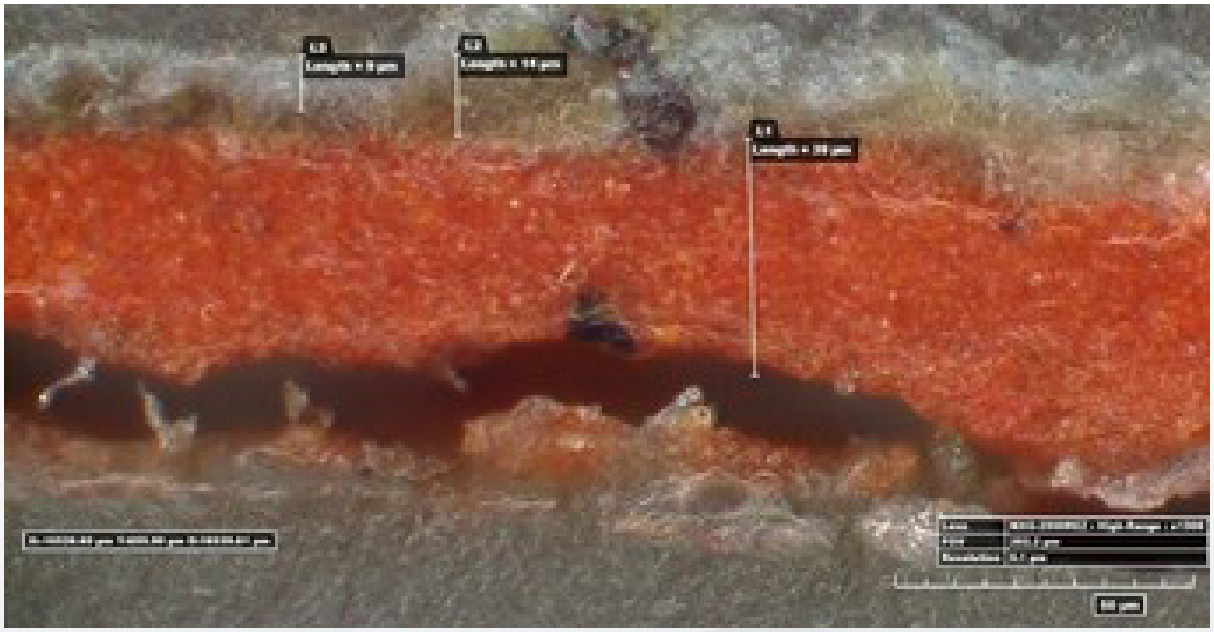
Steel Fire Protection

Later, in the following year of 1946 was the discovery of what is believed to be the first metal aimed intumescent paint. The steel fairings of the aircraft appeared to possess a complex painting stratigraphy with the newest addition of grey paint on the exterior surfaces.



In the cross section we can see a yellow layer with a grey/blue layer on top.
Image: Anna Weiss, 2014

The exterior grey paint can be traced back to 1946 when it was painted, presumably for display. What is underneath and on the interior of the metal fairings, is speculated, are original to the German manufacture.



In the cross section, taken adjacent to the sample above, we can see a red layer, measured at 39 microns, with what appears to be a very thin layer (14 microns approx.) of yellow on top.
Image: Anna Weiss, 2014

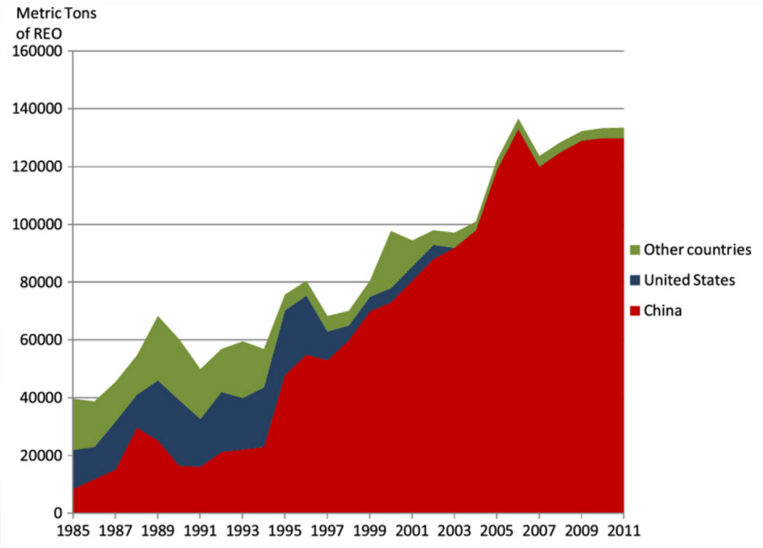
The first fire resisting paints are born, unfortunately similarly to a surprisingly high number of technological advances that we have made, as the result of warfare, the largest form of warfare witnessed in our recent history.

1950's-1960's

These decades see the introduction of APP's into Intumescent Coatings for all materials at the time. It is discovered that these raw materials can be bought very cheaply from the Far East who extensively mine approximately 90% of the global demand for APP minerals.

The market booms, as does the mining damage on the face of the earth. The demand for APP hits record levels as the world discovers they can now effectively start to combat fire damage with the use of a coating.

The commercial birth of intumescent coatings breaks out into industry and the accelerated damage to our planet commences.



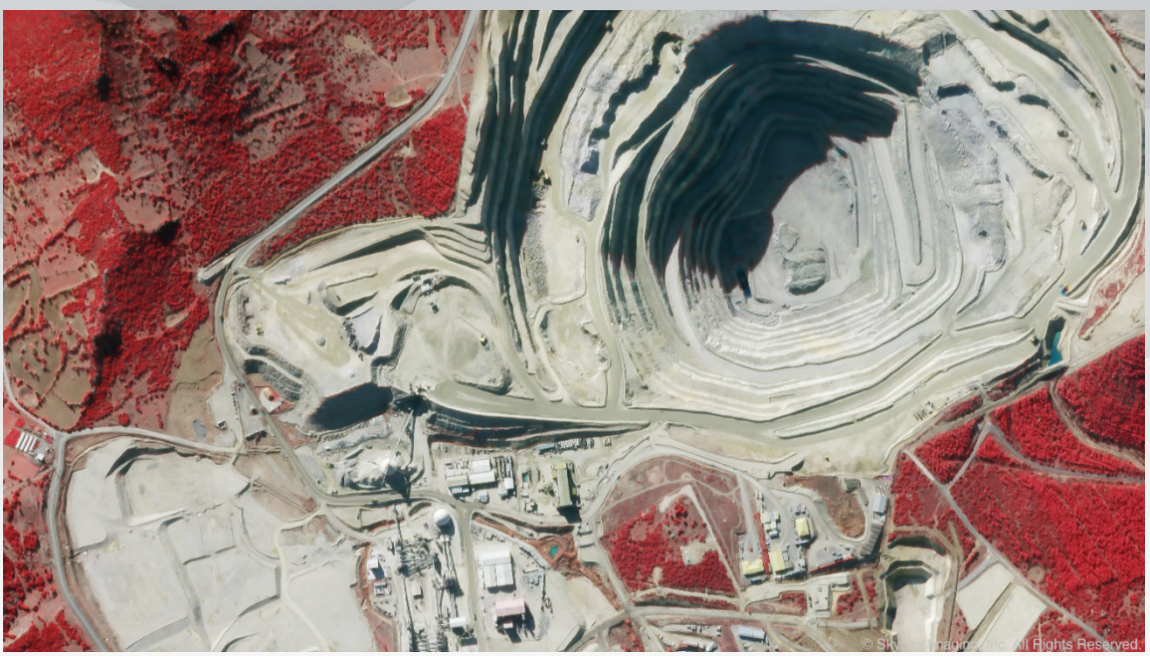
Global Mining Quantities of APP's Aiding in the Destruction of our Planet

Fast Forward to The 21st Century

Technologies and spraying facilities have crept forward with the times offering ever easier methods of applications, the products themselves have been engineered and tailored to perform as best as possible using traditional powders. But what has really changed? We, as an industry are still using powders.

The need for us to continue chewing into the earth's crust to quench mankind's need to ever improve on fire performance does not seem to be vanishing or diminishing.

Where will that journey end if we do not change our thinking?



Fast Forward now to 2019 and the birth of Man Of Fire Ltd (Research & Development)

What if we could replace all of that, with a unique bespoke reacted formula that eventually could be used in every single Passive Fire Coating in the world?

Imagine then that global production of this unique LFR would consume more Recovered Carbon Dioxide than we could produce as a Country, or even an entire Continent!!! Therefore, helping to actually reverse the planets pollutionary state whilst in fact saving lives and property from fire.

Could a leapfrog in Research & Development into Fire Performance change our world?

The answer is simply YES!! We have done it.

Following an intensive 12-month Research Programme and continued Development Programme we have used our Chemicals knowledge, Industry Experience and Scientific Application to producing an utterly unique, clear Liquid Flame Retardant

The Halo LFR Range is developed to be totally unique and bespoke and is designed to be tailored to each unique application type for coatings, impregnation and blending with most materials.

We use Recovered Carbon Dioxide from the planet's pollution stock to process in our reactor alongside other Raw Materials that are Green and Responsibly Sourced. Recovered and Compressed CO2 is used to supercool our Biological Reactor that performs an Exothermic reaction exceeding 1,000°C.

Our development sees the complete END to the use of mineral powders in our formulations, offering crystal clarity to end use fireproof varnishes and many other products.

Our LFR is easily blend able with all compatible systems and has already been used to develop the world's first truly Fire-Resistant Polyurethane Rubber.

.....and this is just the beginning.

Our LFR's have been developed so that we may tailor the formulation as per customer design briefs putting us in a world leading position to offer the following services:

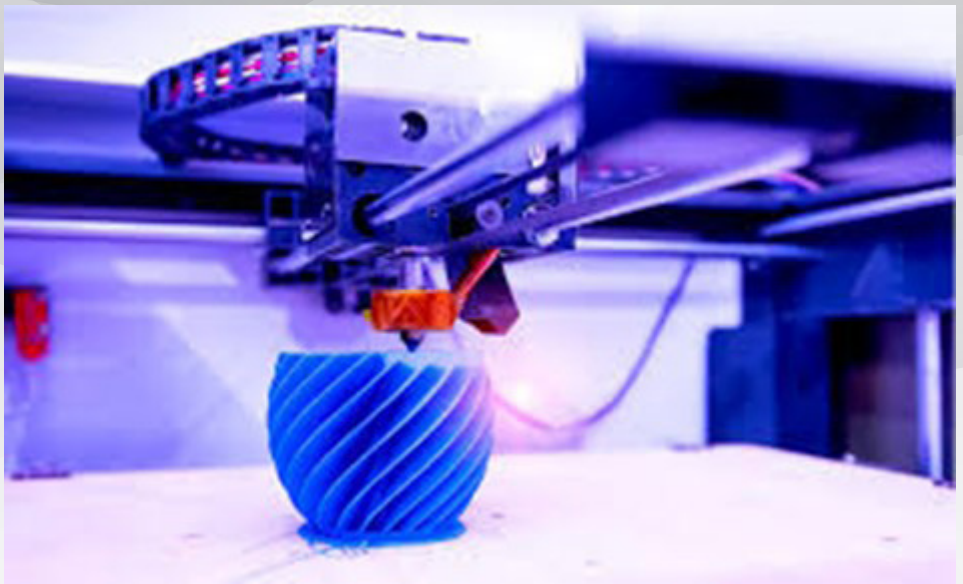
- ✓ In House Research & Development Laboratory
- ✓ In House Fire Testing Facilities
- ✓ In House Production Facility

Alongside our own successful intumescent product line that outperforms any other intumescent coating over numerous specifications we offer full project support and development for some of the world's leading brands in Intumescent Coatings.

Now, we are taking our LFR Technology to the next generational leap forward by developing it for use with synthetic and natural fibres.

- ✓ Kevlar
- ✓ Hemp
- ✓ Carbon Fibre
- ✓ Flax

What about 3D printing fireproof composite materials to any shape or form?



The sky is literally the limit as we currently look at how to stop Fighter Jets melting the decks of carrier vessels and how we look to reduce the weight of commercial airliners by replacing the heavy insulation they use with a thin coating instead offering increased fuel efficiencies and reduced carbon output.

Worth noting is our exceptionally low Activation Temperatures, whereas traditional use APP's activate into an Intumescing Char at 200-300°C, our uniquely formulated LFR's activate as low as 120°C!! Just above the boiling point of water, stopping fire sooner and saving more lives.

They also give off a Non-Toxic smoke when activated which contains a humidity level of 70-80%, what does this mean, it means that our products effectively dampen the air around the fire when activated and force the fire back.

Interested in knowing and learning more?

Drop us a line at Man Of Fire Ltd (Research & Development) and let us help you win YOUR fire fight.

We are a Global Entity, servicing countries from Canada to Australia and everywhere in between.

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