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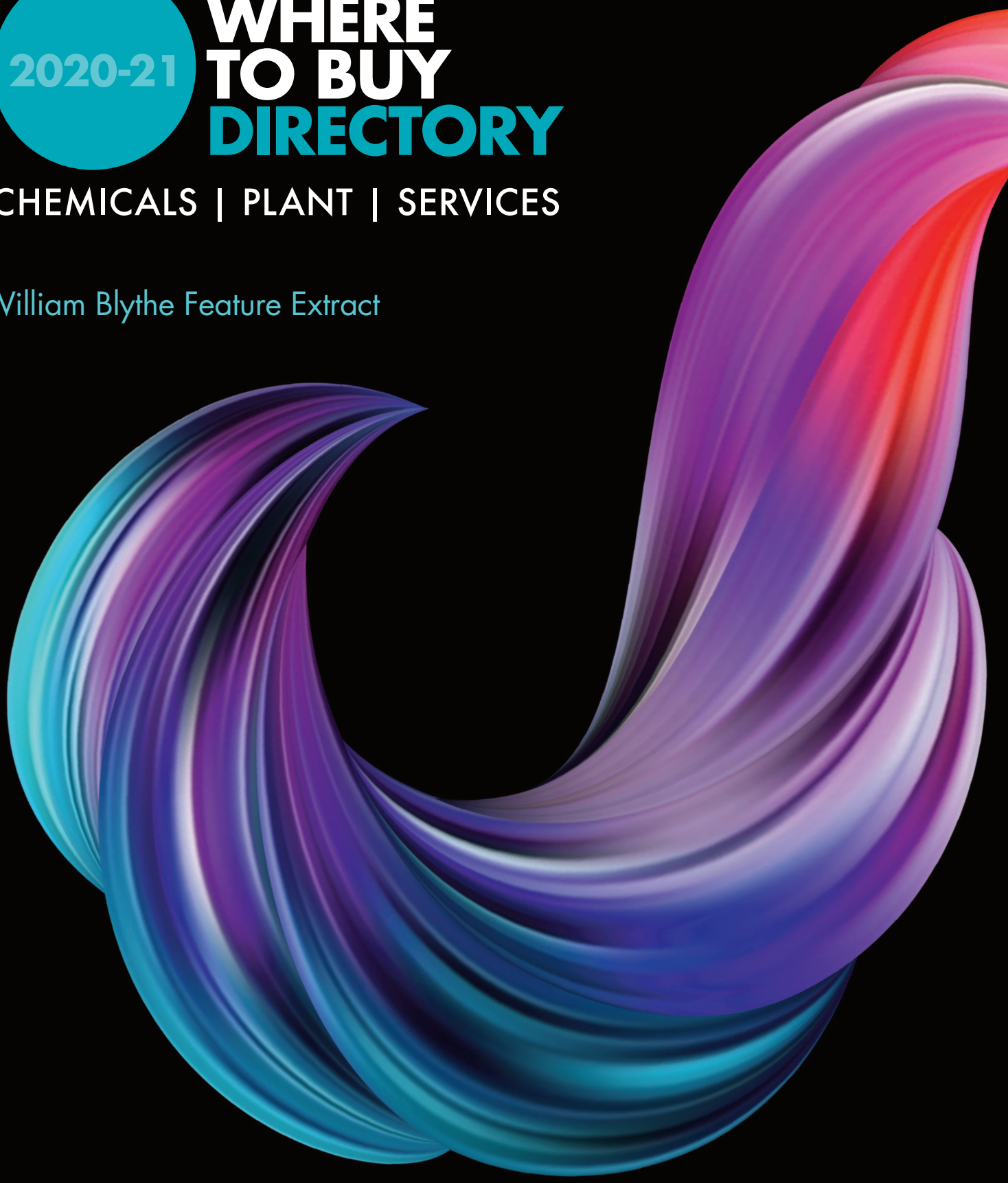
William Blythe Feature Extract



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175 years of chemistry

Kevin Hudson, Sales and Marketing Director, looks back at the long history of William Blythe Ltd and on to its newest developments

William Blythe Ltd is now one of the oldest speciality chemical businesses in the UK. Founded in 1845 in Accrington, Lancashire, it was named after the founder and owner. Initially, the company produced inorganic chemicals for the local textile industry, notably zinc sulphate for use in the production of rayon and zinc chloride for batteries and the dissolution of cellulose.

In 1854, the first William Blythe patent was filed and granted for the development of a novel manufacturing route for sulfuric acid. The company was renamed William Blythe & Co. Ltd in 1892, with William Blythe's sons, William Steward Blythe and Frederick Charles Blythe, appointed as directors.

By the turn of the century William Blythe was manufacturing picric acid for use in the local dyestuffs industry. During this time, sales were also growing to overseas markets, including India, South Africa and the Americas. In order to support this expansion the company opened an office in London and formed agencies in several of the most important overseas markets.

Victorian industrialist William Blythe gave his name to the firm

In 1919, William Blythe acquired the business of John Riley & Sons, a manufacturer of a similar range of acids and metal salts, plus alkali hydroxides and carbonates. By completing this acquisition, the company became the owner of the Hapton works, the largest chemical works in Lancashire.

The 1920s brought a change, with William Collison taking over from William Blythe's grandson, William Fernley Blythe, to become the first Managing Director of the company who was not a member of the Blythe family. It also became a public company in 1928. William Collison remained in this post until the mid-1950s, a remarkable period of service.

Post-war growth

Construction of a new plant to make sodium sulphate and hydrochloric acid from sodium chloride and sulphuric acid was completed in 1955, using two state-of-the-art, oil-fired Mannheim furnaces. In 1957, a 50 tonnes/day sulphuric acid plant was built. Acid from this plant was sold throughout the North West of England and had a reputation for exceptional purity. These are core principles and values we maintain today.

In the 1960s, William Blythe recognised that there was little external process engineering expertise in the manufacture of many of its more specialised metal salts. The company therefore started to build its own in-house process engineering capability, recruiting young chemical engineers who had trained in some of the UK's premier Chemical Engineering schools.

We now started to develop in-house expertise in corrosion resistance and the use of plastics and reactive metals, such as titanium, zirconium and tantalum. The interest in glass-reinforced plastics (GRP) led to the development of in-house capability in the manufacture of GRP tanks and process vessels, including spirally wound tanks. Indeed, we pioneered their manufacture in the UK but later sold this on because it was not a core business.

Hickson & Welch acquired William Blythe in 1969 to safeguard the supply of arsenical salts, notably arsenic acid, sodium arsenate and sodium arsenite. These were all key constituents of Hickson & Welch's fast-growing inorganic wood preservative business. In 1989 came the development, in association with Alcan, of Flamtard H&S fire retardants and the construction of a pilot-scale manufacturing facility.

A novel process was developed in 1990 to produce ammonium thiosulphate solution from ammonium bisulphite solution, liquid sulphur and aqua ammonia. This eliminated the need to store and use in-process liquid sulphur

dioxide and to handle solid sulphur, which carried fire risks. This novel process, in addition to reducing process hazard, also reduced costs and improved product quality.

In the same year, William Blythe was acquired by Holliday Chemicals Holdings as a key part of its growth strategy. This led to significant investment in new products and plants, including the development of a continuous process to produce copper carbonate for use in the timber treatment and catalyst industries in 1994.

Modern times

150-year anniversary celebrations were held in 1995 and attended by members of the William Blythe family. A year later, the construction of a purpose-designed Flamtard manufacturing facility was completed. This has been subject to continuous improvement over the years, to enable material to be produced to an ever-tighter specification, meeting changing customer requirements.

In 1998, William Blythe became a wholly owned subsidiary of Synthomer (then named Yule Catto) as part of its strategy of becoming a major producer of speciality chemicals, as well as latex-based polymers. The development and commercialisation of a process to make high-grade periodic acid to meet the requirements of the electronic industry began in 2001.

Four years later, we developed a means of employing stannous chloride solution as a reductant in the cement industry, enabling cement manufacturers to meet the new legislative requirements for Chromium 6+ content while low-cost commodity reductants were being developed for this application. This is a good example of our ability to respond quickly to a change in the market.

The copper carbonate plant was modified in 2005 to produce copper zinc carbonate for use in the catalyst and gas purification industries. This work developed William Blythe's skills in the manufacture of products with tightly defined physical attributes, understanding the process drivers which affected properties like bulk density, pore structure and specific surface area.

In 2013, William Blythe won the Gold Standard Skills Award in recognition of the extensive training programme it had run over the preceding years. In the same year, a new analytical and R&D laboratory was opened as the company focus shifted to new advanced materials development.

To support this aim, a new multi-purpose production facility was commissioned in 2017. It was designed as a flexible asset to bridge the gap between pilot plant-scale material supply and the construction of dedicated production facilities. In 2018, a new hydrothermal synthesis plant was commissioned.

Current capabilities

175 years on from the founding of William Blythe Ltd., the bulk of company functions still operate and continue to prosper in the original site in Accrington, using the first William Blythe's old home as the main office building.

The modern-day management team consists of David Crossley (Business Director), Pauline Hale (Operations Director) and Kevin Hudson (Sales and Marketing Director) who lead business operations on site, including all manufacturing and R&D. Product sales are supported by dedicated sales offices in Asia and the Pacific, while the site receives further support in other areas such as IT and HR from its parent company, Synthomer.

Today's product range largely comprises the main three chemistries of copper, iodine and tin derivates, which are supplied into diverse markets, such as life sciences, performance coatings, polymers, electronics, catalysis and renewable energy. The chemistries we use to create the product range are controlled bi-tri metallic precipitation, redox reactions and hydrothermal synthesis.

The firm's continued success as one of the UK's largest speciality chemical manufacturers, however, lies not in the specific chemistries, but more in its flexibility and experience in tailoring each inorganic chemical to the specific needs of the customer, regardless of the challenges associated with the requirement. This encapsulates the core capability of William Blythe.

The ability to tune the physical and chemical properties of its products to optimise performance whilst in some cases providing additional functionality is key to the growth of the company. For example, Flamtard, a range of stannate-based powders, can impart both flame retardancy and smoke suppression through in-depth process understanding and material manipulation.

The three synthetic procedures used to create our product range allow strict control over the material's physical and chemical properties, both of which are directly related to application performance, while enabling the use of purely aqueous processing, resulting in a sustainable manufacturing platform. The latter is supported by the company's on-site wastewater treatment plant that removes any hazardous chemicals from its waste stream and imparts flexibility in new product development when scaling up new chemistries.

View of the Accrington site in 1897

Duraguard H_2S absorbents are used in gas processing

Wider capabilities

The company also holds several other capabilities that ensure current and future products can meet customer requirements. This includes a wide variety of purification techniques based around filtration, electrodialysis and ion exchange that can produce very low impurity levels in the resultant materials. In some cases, this extends to ppt levels of trace impurities when supplying products into the electronics industry.

Post-synthesis enhancement is also used throughout the William Blythe manufacturing line. This is used when the required product characteristics cannot be met by first intent, i.e. via precipitation chemistry alone, the material will then be further treated to optimise the properties. Examples of this include granulation, milling, masterbatch and surface modification.

Another capability is closed-loop recycling which gives a customer the opportunity to send waste product back to William Blythe for rework back into valuable product. This creates a sustainable lifecycle for the chemical whilst greatly reducing the raw material cost of the product, in turn reducing cost for the customer.

Quality control (QC) is a key department within William Blythe that helps to confirm all of these capabilities are functioning correctly by characterising every batch of product manufactured at the company. The state-of-the-art QC laboratory enables us to determine purity levels and characterise the physical properties of the material, both of which can have a significant effect on product performance.

The above capabilities have been demonstrated most recently in the development cycle of two of William Blythe's newest products: Luxacal and graphene oxide. Luxacal is a doped tungsten oxide nanomaterial, which possesses near-IR absorption properties that enables applications in inkless in-line digital printing and solar control technology.

The synthesis of this material did not fit within William Blythe's core capabilities, but the team believed in the application's potential and made the appropriate investments in both time and equipment. To deliver this project, William Blythe had to develop expertise in hydrothermal synthesis from scratch as nobody in the company had any prior experience in this field. As part of this project, the company has gained enough technical depth to consider this synthetic technique one of its core capabilities. The new hydrothermal plant gives William Blythe the ability to produce myriad different nanomaterials at precise dopant levels that are not possible with traditional precipitation techniques.

Graphene oxide, by contrast, utilises the company's expertise in redox chemistry. The production method for this material has historically been deemed too dangerous to take above lab scale due to the use of hazardous chemicals, such as highly concentrated acids and strong oxidising agents. Nonetheless, William Blythe was able to scale this process up from lab scale to the current commercial scale in under a year by virtue of its expertise in redox chemistry and rigorous process safety management procedures.

This project was initiated by an internal process named 'Ideation', which was launched in 2015 with the purpose of generating and evaluating potential new R&D projects. The scope was broad and aimed to identify high growth sectors and materials, which were within the current synthetic capabilities of the company. This process quickly identified graphene oxide as a new material that could be synthesised via a route within William Blythe's core capabilities.

After only 12 months of R&D, the process had been optimised and the GOgraphene webshop was launched. Graphene oxide is seen as a technology platform for the company and William Blythe is now running several spin-out projects which are focussed on specific application areas, including water filtration, energy storage and sensors. William Blythe's graphene oxide is already used in commercial products as well as many academic and industrial researchers' laboratories.

Growth roadmap

The rapid development of these two products exemplifies William Blythe's vision for the future in becoming a global leader in the development of advanced materials for 21st century applications.

The expansion of R&D over the past ten years has been one of the key enablers to the success of these new products, the commercial benefits of which are already becoming realised as a result of the bold move made by the senior management at William Blythe to

Masterbatch polymer additive

use innovation as a key tool for achieving long-term, sustainable financial success of the company.

It is widely recognised throughout the organisation that for a chemicals manufacturer to thrive in the current market, with the industry as a whole in decline and cheaper competition in the Far East, it must invest in R&D in order to innovate continuously and provide novel solutions to major global challenges. This led us to develop a technology growth roadmap, which focuses on three principal areas: polymer additives, gas absorbents and advanced materials.

The recent investment into pilot-scale polymer processing and flame testing equipment will accelerate materials development in the **polymer additives** area by removing the stumbling block of acquiring industrially relevant application data. After building up this in-house knowledge, the company expects that this capability will help to build on the existing product range.

Gas absorbents make up one of the newer key growth areas for the company. By understanding the natural gas purification market and how materials changes could lead to performance improvements for the customer, William Blythe was able to develop a new product, and have it qualified by a very conservative market in just 18 months.

Duraguard S100 is a high capacity hydrogen sulfide absorbent offering unrivalled durability and performance to natural gas processing operators. The result of this exceptional project has been the creation of a new market for William Blythe and a product that has already seen significant commercial success. After the first successful charge of Duraguard S100 into a gas plant in 2018, the company has developed sales of this product internationally.

Advanced materials is the final key growth area, with both graphene oxide and Luxacal products falling into this category. Applications for these materials are broad, but the general focus is on materials that can be used either for the betterment of public health or for the environment, following the major trends outlined by government bodies.

Equally as broad is the chemical make-up of the advanced materials, in which there is little restriction on William Blythe. Because of its many years in the chemical industry dealing with a range of hazardous materials, the company has a wealth of experience in scaling up a wide range of chemistries while also being registered as a top tier COMAH site, both of which provide flexibility in chemical scale-up.

Future outlook

To assist in the development of its advanced materials range, William Blythe engages with numerous UK universities and partners with the minds at the forefront of global research. The company currently sponsors two PhD students at UK universities and has recently concluded a two-year long project at the National Graphene Institute in Manchester, investigating the use of its graphene materials in lithium-ion battery applications.

Energy storage is a major focus in R&D and the company holds a portfolio of five projects investigating its manufacturing capabilities for the active materials that store energy in batteries.

In these projects, William Blythe works closely with its parent company, Synthomer, who is already active in the battery materials market, producing SBR latex binders for lithium battery anodes. Synthomer has very recently invested in a small-scale battery production and testing laboratory at Accrington, to accelerate ongoing research into energy storage.

Some of these energy storage projects are collaborative R&D projects ran by the government funding body, Innovate UK, where the company works with a range of academic, end-users and SME technology developers to create supply chains and investigate novel technologies with government backing. William Blythe works via collaborative R&D for many of its advanced materials projects, following the ethos that by working closely with all parts of the supply chain, it will have the highest probability of success.

As these projects come to fruition and new products emerge into the pipeline, William Blythe has the capability to scale these new processes on the original Accrington site, either onto the flexible multi-purpose plant or by designing new dedicated production facilities that will continue to build on from the company's long and successful past.

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