# Cement's new media

While fibreglass, aramid and polyester media remain proven solutions for cement industry applications, a new baghouse application is using a new type of media: polyphenylene sulphide (PPS).

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When it comes to filter media, the strengths and weaknesses of the different media options are well known. Fibreglass media is the workhorse media for kiln baghouses while aramid or polyester versions are the go-to options for clinker cooler baghouses. Acrylic or aramid media, meanwhile, are the most common for coal mill applications. Deviating from these standards increases the risk of shortened filter life and unplanned outages.

## New kid on the block

However, a new baghouse application is using a different media option in some cement plants. The filter media, commonly known as polyphenylene sulphide (PPS), has been introduced to the cement industry as an option in 'polishing' baghouses. This application has specific gas stream requirements that violate the recommended operating conditions of the filter media preferences commonly used at cement plants.

PPS is a manufactured thermoplastic fibre formed of a long chain of synthetic polysulphide with at least 85 per cent of the sulphide linkages attached directly to two aromatic rings. It can be converted into either woven or felted filter media. It has good filtration properties, abrasion resistance and stability. However, certain operating conditions need to be avoided to prevent rapid thermal or chemical failure.

## Avoiding filterbag failure

Filter bags in baghouses fail due to only three reasons:

1. thermal attack
2. chemical attack
3. various types of mechanical failure.

So how does PPS perform against these conditions?

### Thermal attack

The temperature limit of PPS results in very good performance in operating temperatures up to 190˚C (375˚F). Its melting point of 285˚C (545˚F) is well above temperatures reached in baghouses. PPS is also non-flammable.

### Chemical attack

PPS shows a high resistance to chemical attack by most acids and alkalinity. Bromine, in some instances, and strong oxidising agents will degrade the media strength.

In addition, PPS is not soluble in any known solvent below 220˚C (392˚F) while above this temperature, the fibre shows limited solubility in a few solvents.

However, it is not recommended for applications with more than 15 per cent oxygen present. As Table 1 shows, exceeding this recommended level will considerably reduce filter life expectancy.

In recent years, nitric oxide (NO) has been proven to be an even stronger oxidant to PPS felt, leading to more rapid chemical failure than would be the case with $O_2$ alone.

Figure 1: PPS filter media is available in both woven and felt construction

**Table 1: impact of temperature and oxygen level on filter life expectancy**

| Temperature (˚C/˚F) | Oxygen level (%) | Service life (months) |
|---|---|---|
| 204/40 | 0-10 | >24 |
| | 11-15 | <12 |
| | 16-20 | <9 |
| 190/375 | <20 | >24 |
| | >20 | >12 |
| <176/<350 | <20 | >24 |
| | >20 | >18 |

### Mechanical failure

PPS media resists abrasion better than fibreglass but not as well as the aramid filter media. It is considered to have very good filtration properties in depth-filtration form, but applications above 6:1 air-to-cloth ratios should be avoided. As with any baghouse media, mechanical failure such as depth penetration of the media, permeability loss due to dustcake structure (agglomerative build-up on the filter surface), and blinding due to moisture

are only fully preventable with the use of an ePTFE membrane, such as Parker's BHA® Preveil®, on the collection surface of the filter (see Figure 2).

Figure 2: PPS is more resistant to abrasion than fibreglass but not as resistant as aramid media

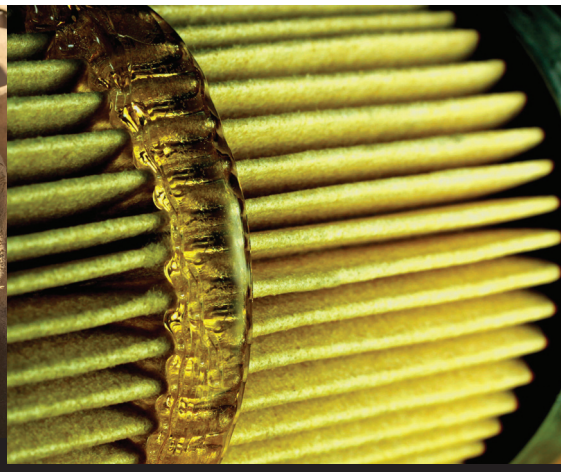

Figure 3: PPS is available in pleated form when filtration area increases are required

## PPS in the polishing baghouse

Recently the application of PPS has expanded from its use on a limited number of mill applications to more widespread use in the cement sector. Several cement plants have installed a new baghouse application, commonly-known as a 'polishing' baghouse.

Polishing baghouses are installed for regulatory or environmental reasons only (such as CISWI or Title V, depending on the fuel used for kiln firing). They are located downstream from a greenhouse gas conditioning system, which is often an ammonia injection system directly mounted on the kiln. In addition, the polishing baghouse has an activated carbon injection (ACI) system upstream, which is installed to control mercury emissions. Providing the kiln baghouse is working efficiently, this part of the gas stream is free from cement dust. PPS filters have been installed in polishing baghouses as they are chemically more likely to perform well as activated carbon dwells within the baghouse, allowing for the desired reaction to occur between the carbon and gas stream.

Therefore, the cement industry should adopt best practices of other industries, such as waste-to-energy, biomass co-generation, municipal solid-waste incinerators and many others that have used PPS for years. In its most common application, the gas flow downstream from coal-fired boilers in the power industry, the technology has provided a shift away from fibreglass filterbags. With its high-temperature rating, robustness when treated with the right finishes and when laminated with ePTFE to the collection surface of the media, fibreglass was the industry's workhorse for years.

However, changing regulations in the power business led to the requirement to scrub greenhouse gasses from their gas stream. New power plants were built with selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR) and activated carbon injection (ACI) systems. In addition, a significant number of existing power plants also benefitted from this technology via retrofits. This gas stream then passed through a final baghouse, now able to run at a temperature as much as 149˚C (300˚F) lower than before due to the required reaction with these new scrubbing systems. If these baghouses flirted with the dew point with regularity, fibreglass filters would fail rapidly. PPS became the media of choice to prevent this chemical failure and will likely remain the recommended material for polishing baghouses moving forward.

Despite the expectation of low grain loading to polishing baghouses, they are responsible for a significant volume of air, ie the entire kiln gas flow. As a result, polishing baghouses will be one of the largest baghouses at a cement plant. PPS is generally a filter media used in large baghouses, so demand can quickly rise and fall depending on market needs. Based on the potential for rapid failure under the right operating conditions, cement plants will need to carefully evaluate the operating conditions of polishing baghouses or risk long leadtimes and high replacement costs. New filter media technology can help in reducing these costs and risks. ■

## The development of PPS resin

- 1967 – Phillips Petroleum awarded a patent for PPS resin
- Ryton® became the trademark for PPS
- Japanese company Toray® developed PPS film and joined forces with Phillips
- Late 1970s—PPS-extruded fibre under the Ryton® name was first introduced to fabric filtration for hot gas applications, EPRI studies showed strong promise for the fabric
- 1980s—PPS replaced thousands of fibreglass and Nomex® bags in problem applications
- 1990s—Several changes of ownership: Phillips sold to Amoco® Fabrics and Fibres, Amoco® sold to BP Amoco®, BP Amoco® sold to American Fibres
- February 2001—Toray bought the PPS assets of American Fibres
- Toray marketed the PPS product, formerly known as Ryton®, under the trade name Torcon®
- Other available sources of PPS fabrics became an option, such as Procon®
- 2010 – Inferior medias blended with other synthetics crept into the market. They were an attractive option due to their lower cost. This generated the need to specify '100 per cent PPS fibres' to ensure product quality
- 2017 – Polishing baghouses using PPS filter media enter the cement industry.

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