

Ceramic filter media for fuel with vast dirt holding capacity

iFleet – a local innovator of filtration solutions – has recently patented a new ceramic filter media ideal for upstream bulk filtration of diesel fuel. *MechTech* talks to André Steyn about the features and advantages of the new technology and its role in helping South African fleet operators to adequately protect new Tier 4 and 5 diesel engines.

■ Fleet, Steyn tells us, develops and supplies complementary products for the truck and transport sector to prevent engine failures; products for contamination control; fuel catalysts and auto-dosing systems to improve lubricity and burn-efficiency; anti-siphoning devices to prevent fuel theft; and kidney systems for fuel bowsers and gensets. “We are currently striving to effectively address the transformation into new engine technology within the African environment,” he says.

The reasons? Modern diesel engines now have fuel injector clearances as tight as two microns and they operate at pressures of between 1 800 and 3 500 bar – compared to injector pressures of 170 bar on the old Atlantic Diesel Engines, ADEs. “The new engines are more powerful with less weight,

which increases heat and stress factors and places much higher demands on both fuel and oil,” says Steyn.

“Contamination in the fuel adversely affects the performance and reliability of the combustion components and this will affect the overall efficiencies – carbon generation, heat, oil, emissions, fuel consumption, lifecycle and failures,” he explains. “Fifty to seventy percent of heavy-duty diesel engine failures are related to the fuel system,” he tells us, “and South Africa has higher levels of dirt with smaller particle sizes than they have in Europe.”

Steyn cites a paper by Raymond Abraham, a fuel specialist with Shell SA, which shows positive correlation between clean diesel and injector wear and performance: ‘When diesel was cleaned from 80 ppm to

1 ppm, injector wear reduced from 10% to 0% when using high efficiency filters, and from 25% to 15% when using standard filters’, says Abrahams. He concludes with the statement: ‘Injector wear due to particulate in diesel can be significantly minimised if customers become aware of the problem and enforce good housekeeping practices’.

Diesel fuel contaminants

Steyn tells us more about the contaminants in diesel fuel. “Clean diesel fuel – fuel that is within specification – still has 25 mg of dirt per litre,” he says. “That’s 25 g for each 1 000 litres. Cleanliness levels on our large mines commonly range between 50-75 mg per litre of fuel.” He compares this figure to the dirt-holding capacity of a premium brand synthetic hydraulic oil filter used to filter fuel – between 160 and 180 g.

“Normal fuel filters struggle with their dirt-holding capacity, which raises the possibility that the filter becomes compromised during its service life-cycle,” he tells *MechTech*. “Dirty diesel can also be much worse than this,” he adds. “A single bad drop or fill-up can destroy the filter media and cause excessive wear or failure on the engine.”

Contamination is highly abrasive at these pressures and tolerances – the fuel becomes liquid sandpaper. There is also a direct correlation between lower fuel lubricity and contamination levels.

The key issue with traditional cellulose media and with nanofibre filter media, says Steyn, is that too many dirt particles will cause the filter to plug. “This results in particles being forced through, a problem which gets progressively worse as the differential pressure across the filter increases.” Vibration and surges also accentuate this problem, as does any ingress of water.

When these media fail, they can cause problems in three different ways. Firstly, the previously trapped particles can be released to pass through the break. This is called unloading. Secondly, the media fibres them-



André Steyn of iFleet (Pty) Ltd, shows MechTech a ceramic diesel filter on trial at MacDonald Transport.

selves can break off and migrate through the filter and thirdly, consecutive breaks can form a channel to allow fuel to by-pass the filter media.

The solution? iFleet's new patent is a ceramic filter designed to overcome all of these problems and more. The new filters use a ceramic media – chrome-sand bound and a proprietary binder. "These filters offer three key advantages over traditional media," says Steyn. "Low differential pressures, very high dirt holding capacity and excellent cleanliness levels."

The iFleet ceramic filter media has a porosity of 33%, which allows for very low differential pressures. This allows for the use of depth filtration principles without the high-pressure differentials that are associated with the traditional cellulose- or fibre-based depth filters. "Traditional depth-filter media also have serious problems with water which blocks the filter and causes channelling, injector cavitations or fuel starvation," Steyn tells us. "Our ceramic filter cannot break and it can filter almost all gases or liquids, even water."

The depth filtration design allows for a very high dirt-holding capacity, "at least five times higher than traditional filters," says Steyn. "This makes them ideal for the bulk filtration of diesel into or out of a bowser."

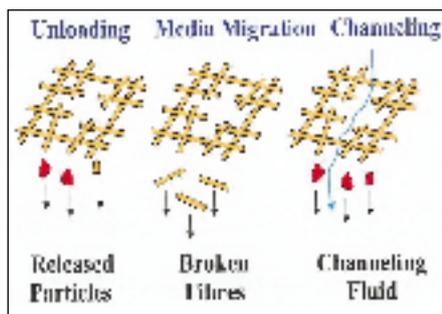
He shows us an iFleet trial system that has been filtering the bowser at MacDonald's Transport for the last six months. "The filter can be used to guarantee sustainable cleanliness levels," adds Steyn. "It cannot break, it can only block. Therefore you will always know that your diesel is being filtered. This is not the case with traditional filters," he explains. "When a traditional filter in a system reaches its maximum differential pressure – or experiences vibration or surges – it will either go into by-pass or it will break through the media. The filter may look OK, but it is actually doing nothing."

In terms of cleanliness the ceramic filter media starts its life filtering at five microns. "As more dirt gets trapped, the filter becomes increasingly efficient, and it will get better and better."

Patents

iFleet has taken out two separate patents on the designs, one for the use of ceramic filters to filter hydrocarbon fuels and a second for the use of ceramic filters for filtering the air going into hydrocarbon fuel- and oil-breathers for storage tanks.

Steyn uses a truck's fuel tank to empha-



Schematic diagram of the three failure mechanisms associated with traditional filter media.

size the importance of filtering a breather: "It is very important to filter the breather of a truck's fuel tank," he exclaims. "These breathers often sit in the dust cloud created behind the wheels. All that dirt is being sucked into the fuel and will cause serious problems unless both the dirt and the water is taken out," he predicts.

The future? iFleet is attracting a lot of interest for a wider

range of applications: for air emissions from industrial towers; high flow applications in air, gas and liquid; fuel refineries which filter over 160 litres per second at 10 bar; garage forecourts and mine fuel bowsers; soot removal systems from air brakes and water filtration for cooling towers.

"We are currently negotiating with a number of OEMs to get ceramic filters incorporated as part of their product ranges. Filters are available in lengths from 1,0 metre down to 30 mm. And we can now supply in-line, spin-on or box filters as well as breathers," says Steyn, "and we can also do industrial customisations," he adds.

Reference: Raymond Abraham- Fuel Specialist, Shell S – Dirt in Diesel: Fleet-watch



iFleet's patented ceramic chrome-sand filter media allows for depth filtration with substantial gains in dirt holding capacity – more than five times better than traditional cellulose or fibre-based media.

Ceramic filter performance criteria

- **Reliable performance:** absolute removal of solids from fluid streams to any specified micron size.
- **High integrity:** fixed pore construction prevents seized particles from being released back into the liquid stream during flow or pressure surges.
- **Low resistance to flow or differential pressures:** the high porosity minimises pressure drops across the filter and resistance to flow. This low resistance has a direct bearing on filter life.
- **Very high collapse strength:** important because on collapse, unfiltered fluid can be routed back into the system. The ceramic filters will always block and not break.
- **High structural integrity:** ceramic filter media will not leak due to holes or channelling.
- **High capacity and efficiency:** ceramics have both high dirt holding capacity and excellent guaranteed cleanliness levels.
- **Longer life and lower costs:** high surface area results in high dirt holding capacity and long element life for lower net operating costs.
- **Chemical capability:** media is compatible with both hydrocarbons and water. Most depth-filter media are highly sensitive and can block due to water retention before particulate clogging.