New FFKMs:

Produce Seals that Withstand Chemicals, Fluids and Heat

Seals, gaskets, o-rings and packings take abuse when they are used in enhanced oil recovery techniques like gas injection. New FFKM resins produce components that can withstand these extreme temperatures, pressures and chemicals. These components last far longer, preventing leaks that result in costly downtime.

Conventional oil and gas discoveries globally have been in steady decline in recent years, with 2014—the last year in which figures are available—registering the lowest volume of new finds in the past two decades. With continuing low energy prices holding down investment in exploration and production, prospects for a reversal of this downward trend in the near future are limited.

Much untapped oil and gas remains in existing wells, however. The U.S. Department of Energy (DOE) estimates that primary recovery methods—which rely on the natural pressure of the reservoir or gravity to drive oil into the wellbore, combined with pumps to bring the oil to the surface—typically tap only 10 percent of a reservoir's oil. Furthermore, secondary efforts to extend a field's productive life—generally by injecting water or gas to displace oil and drive it to a production wellbore—still only push recovery totals to between 20 to 40 percent of the original oil in place.

ENHANCED OIL RECOVERY

As a result, oil and gas exploration and production (E&P) companies are increasingly using enhanced oil recovery (EOR) techniques to extract as much of the remaining 60 to 80 percent out of the reservoir as is economically feasible. These newer production methods typically utilize gas, thermal, or chemical injection to extend the productive life of a play.

- ***Gas injection*** uses natural gas, nitrogen or carbon dioxide that expands in a reservoir to push additional oil to a production wellbore—or other gases that dissolve in the oil to lower viscosity and improve its flow rate. According to DOE, gas injection now accounts for nearly 60 percent of EOR production in the U.S.
- ***Thermal recovery*** introduces heat, typically steam, to lower the viscosity of oil to improve its ability to flow through the reservoir. Thermal techniques are employed in over 40 percent of U.S. EOR production.
- ***Chemical injection*** uses long-chained molecules called polymers to increase the effectiveness of waterfloods or the use of detergent-like surfactants to help lower the surface tension that can prevent oil from moving through a reservoir. Chemical techniques figure in about one percent of EOR production in the U.S.

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FFKM SERIES

These methods are becoming increasingly popular, yet they all place significantly more strain on mechanical seals, pump seals, O-rings, gaskets, T-seals, and packings than traditional recovery techniques. These components are the workhorses of downhole oil and gas recovery applications.

Exposure to high temperatures can cause these seals to lose their elasticity, making them hard, brittle and susceptible to outgassing. Contact with harsh chemicals and solvents can cause some elastomeric seals to swell, potentially leading to their rupture and the contamination of both the process and outside environments.

NEW AFLAS ULTRA-POLYMERS

To meet the challenges of operating in these harsh environments, AGC Chemicals has developed new , high-performance resins for O-rings, gaskets, and other oilfield seals and packings. Components made from these peroxide-curable perfluoroelastomers (FFKMs) provide the industry's greatest resistance to the high temperatures, pressures, and increasingly aggressive chemicals employed in oil and gas recovery. These new resins exhibit superior performance characteristics to the FKM and HNBR families of elastomers now commonly used in many oil and gas industry applications.

These new FFKM resins can also be used to fabricate parts for demanding applications in the harsh environments found in the chemical processing, industrial equipment, food handling, semiconductor manufacturing, pharmaceutical, heavy-duty diesel, and automotive industries.

The chemical structure of these new AFLAS resins is derived from tetrafluoroethylene and perfluoroalkyl vinyl ether, which offers the highest resistance to chemicals, oils and solvents. These resins also provides excellent compression set, mechanical strength, electrical insulation, and ease of processing. They can also be compounded to be highly resistant to rapid gas decompression.

The thermal capacities of these new resins range from 230-270 °C peak excursion exposure, so components formulated with these resins resist wear and last longer in critical applications than many competing materials. The result is significantly less downtime, lower maintenance or repair costs, and improved productivity.

CUSTOMIZED PARTS

Unlike other FFKMs, the new AFLAS resins are supplied to customers as raw product, rather than as a finished part, allowing manufacturers to customize the finished part for their clients' specific needs. However, this requires that these resins be optimally formulated, molded, and cured to take full advantage of their physical properties.

The optimal formulation depends on the intended use in each case. Press cure conditions (temperature and time) must be decided in consideration of a variety of factors, such as the size of parts, required properties, and scorch safety.

To achieve the best physical properties, these new resins also require a post cure. The recommended standard condition for each is 250°C for ≥ 4 hours in air. Cure times must also be optimized based on the size of the part.

AN EXPANDING LINE OF FFKMS

As specialty elastomers designed to perform without failure in the most aggressive operating environments, the new AFLAS resins are priced commensurately. When selecting materials, designers, it manufacturers and users should also consider the "costs" of using lower performing resins for mission-critical components of oil and gas E&P operations. Elastomeric seals that underperform and leak or rupture can be a safety, environmental, and liability risk resulting in incalculable costs to human life, aquatic and atmospheric ecosystems—and a company's reputation.

ABOUT AGC CHEMICALS AMERICAS

For almost a century, AGC Chemicals has been manufacturing high-performance materials serving industrial customers. Already the world's largest, longstanding custom compounder of PTFE and other fluoropolymer resins, AGC continues to build its product line with the introduction of FFKM resins that meet the growing demand for tougher, more durable products for today's production and manufacturing environments.

For full product specifications on AGC's newest high-performance resins, as well as handling and storage instructions, please visit **AFLAS PM-1100** and **AFLAS PM-3000**, or alternatively call toll-free (in the U.S.) at (800) 424-7833 to speak with a technical sales representative.

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