CASE STUDY

Celanese

CELANESE SOLUTIONS HELP EKPO FUEL CELL TECHNOLOGIES MEET FLEXIBLE DESIGN GOALS FOR FUEL CELL STACK MODULES

New EKPO NM5-EVO fuel stack with molded components made from heat- and chemical-resistant materials from Celanese.

PROJECT

EKPO Fuel Cell Technologies (EKPO), a joint venture (JV) between automotive Tier suppliers ElringKlinger and Plastic Omnium, was formed in March 2021 to develop and industrialize fuel cell technology to accelerate the development of hydrogen mobility. The JV benefits from both companies' expertise in industrial- scale production to supply stacks and components in large-scale volumes with the help of highly efficient, automated manufacturing processes – fully audited and in proven automotive quality.

The new company quickly got to work, and one of its first commercial successes is the NM5-EVO fuel cell stack platform. The NM5-EVO delivers high power density, with a flexible, compact design that enables its application by OEMs in many makes and models of cars, commercial, and heavy-duty vehicles, in various applications and systems.

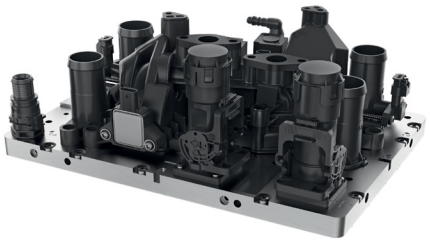
Hydrogen-based technologies are of significant interest to the global automotive industry because of their ability to greatly reduce CO2 emissions. In fact, if the hydrogen is generated from renewable resources, the drive system that relies on the fuel cell technology can be considered CO2-neutral. Hydrogen fuel cell technology is being considered for a wide variety of vehicles, from cars to long-haul trucks to LCVs, and even for ships, trains, and aircraft.

CHALLENGES

Designing and manufacturing a powerful, modular and compact fuel cell stack is a significant engineering feat. The experts at EKPO collaborated closely with engineers and scientists at Celanese to identify a material that was up to the challenge.

The NM5-EVO is a platform to be used on different types and models of vehicles. Its design includes standardized automotive fluid and media connections, an anode loop with integrated water separator, purge and drain valves, as well as other necessary connections and sensors, all packed into a housing. Besides the media supply, a cell voltage measurement unit is also integrated, mounted with components molded with Celanese Crastin® PBT. The need for safe and reliable operation under various conditions (including freeze start of -30°C) and lifetime requirements challenged the team.

Each cell in the stack needs to function independently, and this places enormous demands on the thermoplastics selected for the many components of the media supply. These polymer parts must perform under aggressive conditions, with different fluids, in a very small space. EKPO had experience manufacturing these components using various thermoplastic materials but was seeking a material that offered greater processability.



The collaboration between EKPO and Celanese enables the efficient molding and assembly of these intricate, compact modules.

SOLUTION

To support the engineering team at EKPO, Celanese fine-tuned an established grade from its range of Zytel® HTN EF electrically friendly materials to meet the special demands of fuel cell components. The new grade was optimized to enable extremely efficient molding and to be laser welded. Together, these supported the customer's goals for efficient production and also enabled the compact, complex design.

Importantly, the solution also offers extremely high levels of purity, which is critical to ensure there is no reaction with the fuel cell medium or poisoning of the cells. The high CTI value of this special Celanese solution gave it a significant advantage over the previously used material.

The material's dwell time and resistance to flash build-up helped EKPO optimize its molding machines' efficiency. Dimensional stability and the resistance to aggressive fluids and internal pressure of up to 2.5 bara ensured components molded from the material would remain safely leakproof through the long useful life of these fuel cell stacks.

Components manufactured from Celanese Zytel® HTN EF include media modules, cathode end plates, anode endplates, and gasket carriers. In addition, the cell voltage measurement side covers are molded from Crastin® PBT.

CELANESE ZYTEL® HTN: FOR WHEN THE GOING GETS TOUGH

The Zytel® HTN EF specialty solution is part of Celanese's family of electrically friendly thermoplastics. Within this group, Zytel® HTN occupies a special place due to its outstanding combination of resistance to heat aging coupled with its extreme chemical resistance.

Key advantages of Zytel® HTN EF include:

- Insulating, electrical resistance
- Heat resistance
- Chemical resistance
- Strength and stiffness
- Dimensional stability
- Hydrolysis resistance
- Fatigue resistance
- Ease of processing

The Celanese Zytel® HTN EF heat-stabilized and electrically friendly product family delivers material grades with more stable electrical properties compared to inorganic heat-stabilized materials. This product family is designed for applications requiring continuous temperature up to 185°C, low water absorption, high chemical resistance, and dimensional stability. Formulations with different glass fiber levels and reflow soldering capability are available depending on customer requirements.

Form No. 001-20718-HMC0123