KYOCERA Fineceramics Europe GmbH

Containment shells

Ceramic containment shells made of FZM ceramic for use in magnetically coupled pumps have clear benefits compared to other materials: Their use significantly increases process safety for people, machines, and the environment, while simultaneously optimizing service life and energy efficiency.

Ceramic high-performance material for maximum safety

All processes involving the pumping of toxic, odorous, or other aggressive media require highly specialized process technology to maximize the protection of pumps, employees, and the environment.

Due to its beneficial properties in several relevant areas, high-performance ceramics has been established as the most efficient material for containment shells used in magnetically coupled pumps. 20 years of experience have culminated in our current FZM ceramic containment shell manufacturing process. The resulting product is marked by high mechanical strength and flexibility, extremely good corrosion resistance against acid and alkali, and high temperature resistance against temperatures of more than 450°C. These properties make our ceramic containment shells wear-free, allowing for maximum product life and maintenance-free operation. Due to its high chemical resistance and the significantly longer service life compared to conventional materials, it is particularly suitable for use in corrosive media. When designing the ceramic containment shells, the good mechanical properties of the material, such as high compressive strength and low E-modulus, are complemented by FEM analyses. These enable a design suitable for ceramics, so that all stresses can be absorbed even at pressures of up to 60 bar (pressure level PN 40).

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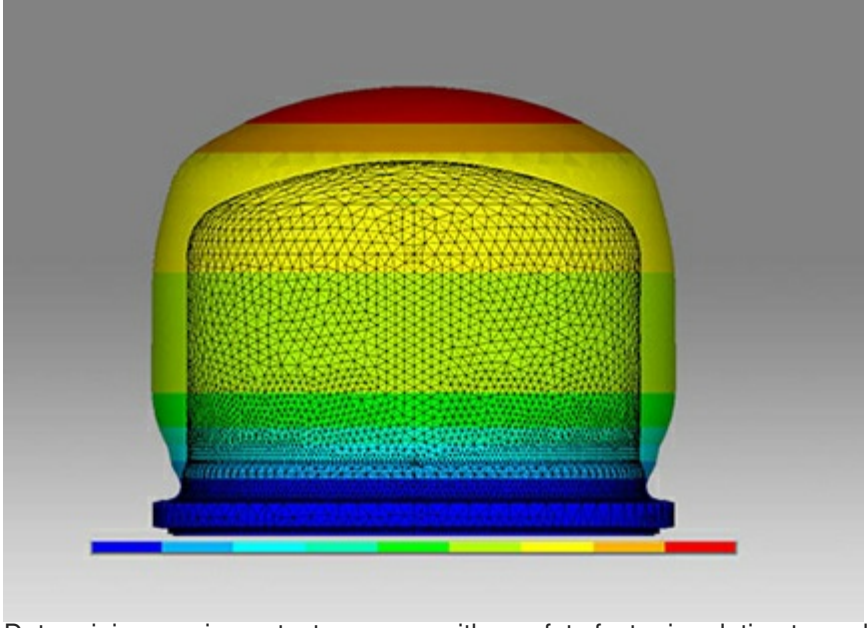


Determining maximum test pressure with a safety factor in relation to working/ nominal pressure using FEM analysis.
100 % of containment shells undergo pressure testing.
Current max. dimensions - flange diameter: up to 400 mm, height: 400 mm

Unlike metallic containment shells, ceramic containment shells are not electroconductive. Eddy currents that reduce performance are prevented and energy efficiency is significantly improved. Therefore it is possible to reduce the drive power of a pump up to 15 percent. In addition, losses due to eddy currents generate up to 20 kW of heat, which may constitute a safety risk depending on the process and the media conveyed. In the case of substances close to their boiling point or explosive materials, any additional heat input should be minimized.

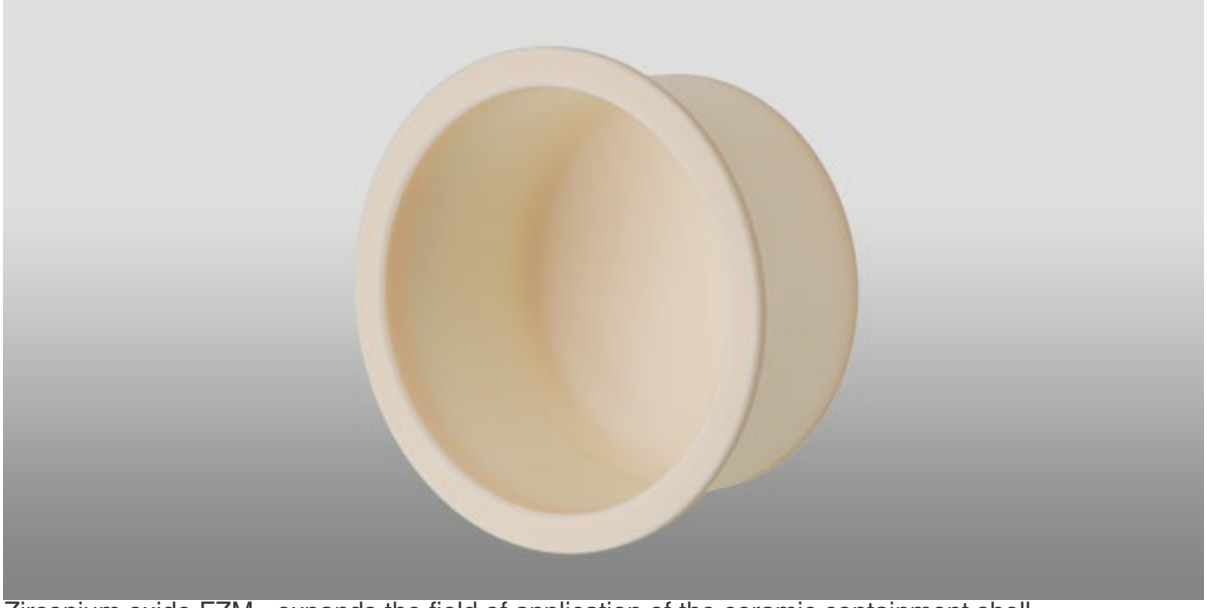
Optimized energy efficiency thanks to ceramic containment shells

Improving the energy efficiency of pumps and pump systems is of great importance to the overall process. Compared to metal containment shells, ceramic containment shells produce no eddy currents, which results in significant energy savings, and contributes to protecting the environment. Companies have as such an efficient way of meeting the requirements of the new European climate law and the carbon pricing stipulated in the national climate protection program for Germany. Model calculations show that the annual savings for a pump range from around 2,600 to around 19,600 euros, depending on the speed and electricity price (assumptions: 8,000 operating hours per year, speed 1,500 or 3,000 rpm, electricity price between 12 and 18 ct/kWh). In this way , the extra cost (or the higher purchase price) of a ceramic containment shell compared with its metal counterpart is usually recouped through the electricity savings alone after just a few months to a maximum of half a year. The CO_2 savings per pump applying the assumptions mentioned are between 13 and 68 metric tons per year.

Also, the distance between the outer and inner magnets is an important factor for reliable long-term performance. Our unique grinding technology allows a reduction of the wall thickness of ceramic containment shells to only 2-4 mm in the cylindrical section.

Modified material FZM+ opens up new possibilities for increasing requirements

Pump applications demand higher and higher pressures, temperatures and performance while at the same time increasing pump efficiency. Kyocera has developed a new ceramic material to meet these requirements: the white zirconium oxide FZM+ is characterized by improved flexural strength and high fracture toughness. As a result, test pressures of up to 95 bar (pressure stage PN 63) can be achieved. It is suitable for use in the cryogenic area as well as for external pressure applications with gas as the medium.



Zirconium oxide FZM+ expands the field of application of the ceramic containment shell

Coatings for ceramic containment shells complete the portfolio

Applying a chemical-resistant, pore-free coating to the inside of our ceramic containment shells makes them suitable for pumping highly aggressive acids such as hydrofluoric acid. This leads to much longer service times and an expanded range of applications.

Coating the outside with titanium nitride reduces electrostatic charges and expands potential applications of the isolation shells in Group II explosive atmospheres to Category 2, Zone 1.

Ceramic containment shell, outer coating: titanium nitride, inner coating: ETFE

Factsheet

Dimensions:
diameter up to 400mm, length up to 400mm
Pressure levels:
PN25; PN40; PN63
Energy efficiency:
Saving of energy and CO2 emissions, as performance-reducing eddy currents are avoided
Chemical resistance:
extremely good corrosion resistance to acids and alkalis
Temperature resistance:
>450°C / supplementary testing enables use down to -180 °C
Protection of pumps, environment and employees:

Avoidance of additional heat input minimizes the risk of delayed boiling or deflagration with potentially explosive media