Nautilus
MARINE SERVICE GmbH

Introduction to VITROVEX®

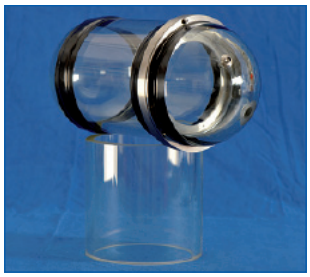
High quality glass floatation and instrument housings

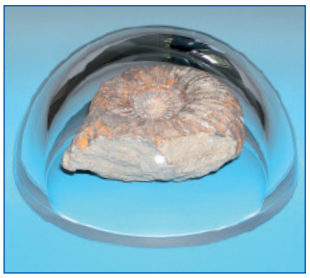
All stationary and autonomous instrumentation for observational activities in ocean research have two significant things in common. Firstly they require pressure-resistant housings and secondly they need buoyancy to bring instruments safely back to the surface. The use of glass spheres is naturally attractive for meeting both these requirements.

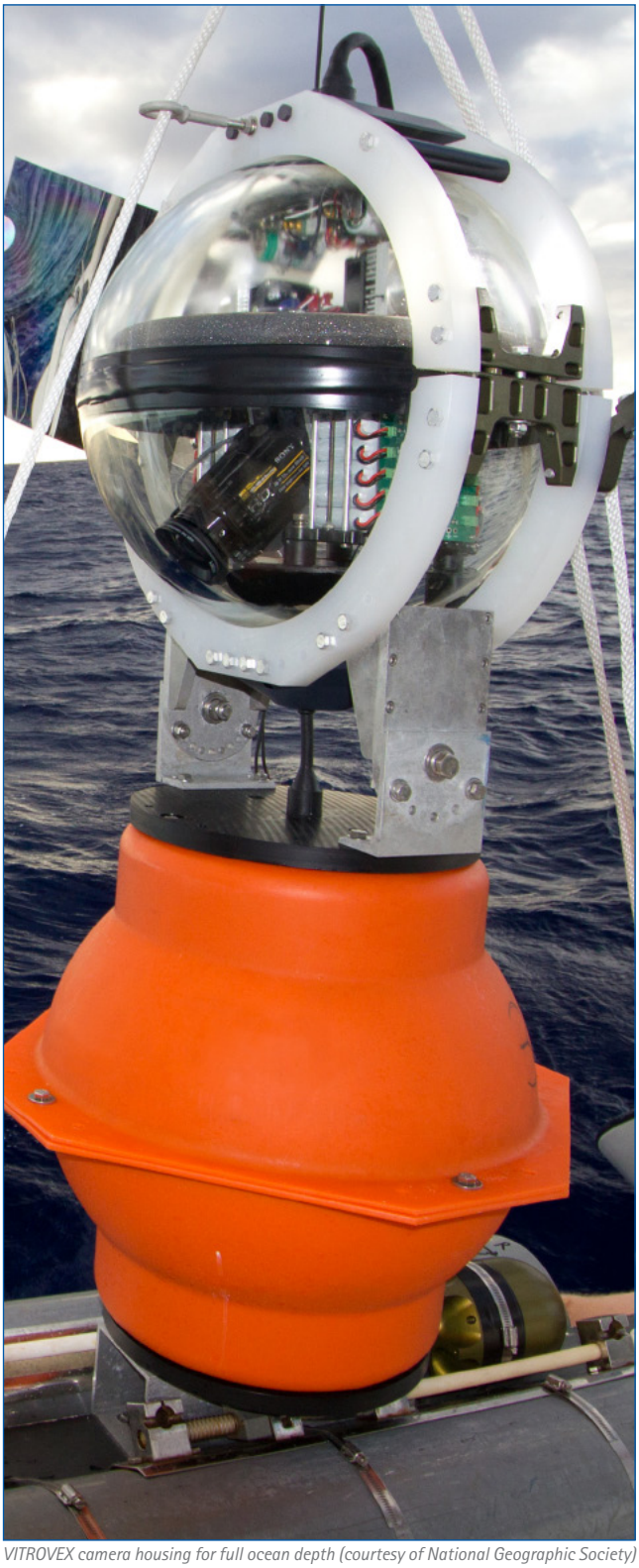
Glass spheres for buoyancy or instrument housing application are composed of two mated glass hemispheres that are evacuated and locked into position by a sealant and a protective tape. Once the spheres are sealed, the two hemispheres are kept together by the atmospheric pressure on land and the pressure of the water column when deployed. Spheres employed as instrument housings incorporate a vacuum port to facilitate repeated sealing and unsealing actions.

VITROVEX® spheres are made of borosilicate glass 3.3 with standardized physical, chemical, electrical, and optical properties, also well known as **DURAN**®. This kind of glass was first developed by the German glassmaker Otto Schott in the late 19th century.

Since the early 1990s Nautilus Marine Service GmbH has been successfully producing flotation spheres and instrument housings for deep ocean research.







VITROVEX camera housing for full ocean depth (courtesy of National Geographic Society)

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Advantages of VITROVEX® glass floatations and instrument housings

- Immense strength to weight ratio
- Inherently low cost compared to alternatives
- Corrosion resistant
- Non-polluting (environmentally friendly)
- Transparent, nonmagnetic, and electrically nonconductive
- Spheres can be made with a variety of high precise drill holes to accommodate connectors, feedthroughs, and a vacuum port for connection to electronics and batteries inside, or releases, sensors or other packages on the outside
- Control of instruments including data up/download may be done through the glass with hall effect, reed switches, infrared, blue tooth or just by commonly available electrical connectors
- Radio and flashing light recovery beacons work effectively housed internally. GPS, ARGOS, or Iridium transceivers as well as VHF radio links penetrate the glass without problem. Status lights and LCD displays are visible before deployment.
- High-quality **VITROVEX®** glass can be polished to enhance optical properties for high-resolution digital cameras
- For protection, storage, and ease of handling LDPE (low-density polyethylene) protective shells are available as well as mounting framework with swivelling sphere fixings, rope, thimbles and shackles (EDDYGRIP system).

VITROVEX® spheres show very little deviation in shape even under high pressure. In addition to precision moulding of the highest quality glass, skilled craftsmanship ensures that each hemisphere is pressed to exactly the same dimensions. As a result **VITROVEX®** hemispheres of the same outside diameter and wall thickness are completely interchangeable, individually replaceable and require no special alignment of hemispheres during assembly.

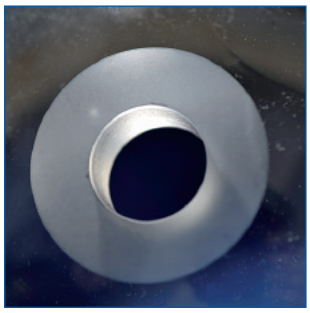
Glass properties of VITROVEX®

Thermal coefficient of expansion: 3.3 x 10–6/°K
Specific gravity at 25°C: 2.23 g/cm3
Young's modulus: 63 GPa
Poisson's ratio: 0.20
Refractive index nd: 1.472
Thermal conductivity at 90°C: 1.2 W/m x °K
Specific heat: 0.8 J/g x °K

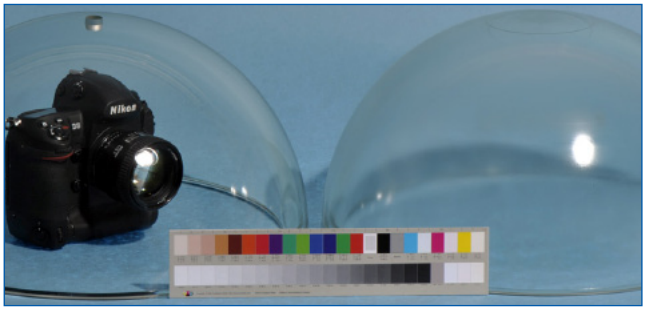
VITROVEX precise geometry

Instrument sphere ready to use

VITROVEX batterie housing



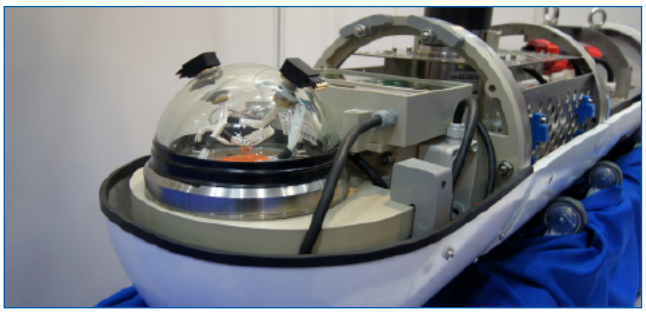
Drill hole and ground flat



Polished vs. standard hemispheres

Vacuum port and manometer

Vacuum port and hose adaptor



Instrument sphere in AUV

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