

A High-Tech Material for Superlatives

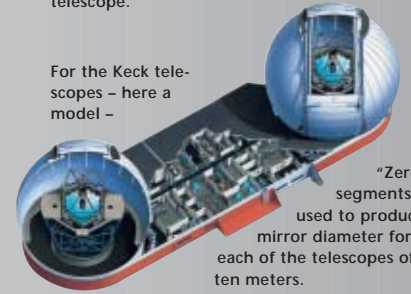
For more than 30 years, "Zerodur" glass ceramic has been astronomers' material of choice on Earth and in outer space. Here is a summary of some of the spectacular projects with mirror substrates made from "Zerodur":

- 1970 – 1975 Mirror substrates with diameters of 1.3 meters, 2.3 meters and 3.6 meters for three telescopes of the MPIA (Max Planck Institute for Astronomy) on Calar Alto in southern Spain.
- 1975 2.3-meter mirror substrate for the biggest telescope in India.
- 1984 Eight "Zerodur" cylinders for the German X-ray telescope known as ROSAT (ROentgen SATellite), which was used in space from 1990 to 1999.
- 1986 An extremely thin 3.6-meter mirror substrate for the New Technology Telescope (NTT) of the ESO, the first telescope with active optics.
- 1990 24 cylindrical mirror substrates for the X-ray telescope known as "Chandra," which was launched with a space shuttle in 1999.
- 1990 3.6-meter mirror substrate for the Galileo TNG telescope on La Palma.
- 1986 – 1990 42 hexagonal segments made from "Zerodur" with a diameter of 1.8 meters for KECK I, a 10-meter telescope on Mauna Kea, Hawaii.
- 1991 – 1993 42 "Zerodur" segments for KECK II.
- 1993 – 1996 Four 8.2-meter mirror substrates for the Very Large Telescope (VLT) of the ESO, the world's largest glass ceramic pieces produced from a single cast.
- 1993 – 1996 100 1.0-meter hexagons for the 9-meter American-German Hobby Eberly Telescope (HET).
- 1997 Lightweight 2.7-meter mirror substrates for the Stratospheric Observatory for Infrared Astronomy (SOFIA), an infrared telescope on board a jumbo jet.
- 1999 – 2002 42 mirror substrate segments for GRANTECAN (Gran Telescopio Canaria), a 10.4-meter telescope on La Palma.
- Since 2001 40 "Zerodur" hexagonal segments with a diameter of one meter for the Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST) in China.
- 1997/2002 Two weight-reduced secondary mirror substrates with a diameter of 1.7 meters for the 6.5-meter U.S. "Magellan" telescope.
- 2002 Sample fabrication of "Zerodur" precision mandrels for the production of mirror segments for the planned "Constellation X" X-ray telescope of NASA.
- 2002 – 2003 4.1-meter mirror substrate with a particularly strong curvature for the Visible and Infrared Survey Telescope for Astronomy (VISTA), the world's largest wide field survey telescope.



SCHOTT/Heinz Göttert

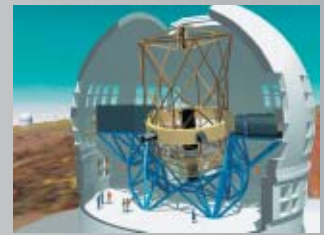
Mirror cylinders made from "Zerodur" glass ceramic for the ROSAT X-ray telescope, and later also the "Chandra" telescope.



For the Keck telescopes – here a model –

"Zerodur" segments were used to produce a mirror diameter for each of the telescopes of ten meters.

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GTC

GRANTECAN (model): the telescope with a 10.4-meter mirror made from "Zerodur" segments will be the largest telescope in the Northern Hemisphere.



LAMOST

With the LAMOST the Chinese will have a powerful telescope at their disposal in the near future. SCHOTT has delivered 40 hexagonal segments for this telescope.



SCHOTT/Jürgen Hartmann

Weight-reduced, "honeycombed" mirror substrates made from "Zerodur" glass ceramic are used in the "Magellan" telescope.



SCHOTT/Thomas Bauer

4.1-meter mirror substrate for VISTA, the most powerful wide field survey telescope in the world.