

solarconcrete

solarconcrete is a compound material of lightweight concrete and a solar element consisting of plexiglass, aluminium coating and an absorbing black coating. It enables facade concrete buildings to use solar energy to heat up the south facade during heating period. With this system on sunny winter days the wall works like a panel heating emitting the stored heat 6 to 8 hours later into the inside of the building.

the functional principle is based on the technology of transparent insulation. solar light is transmitted through a transparent material, which has a low thermal conductivity, onto an absorbing black coating where the light is transformed into heat.

while existing systems of transparent insulation normally create an extensive opaque glass facade, solarconcrete offers an aesthetically honest design.

to guarantee an efficient system the following conditions have to be considered:

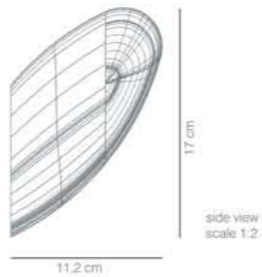
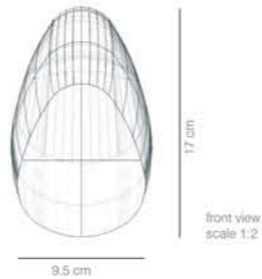
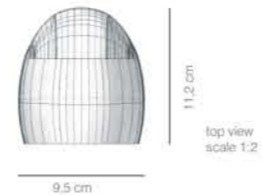
- the building site should be located in an area of high solar radiation but at the same time cool temperatures during winter
- the building should be orientated to the south
- in winter the south facade has to be without shade, in summer radiation must be blocked to avoid unintended heating-up

several problems of the existing systems could be the reason why transparent insulation is not carried out widely:

- most of the existing systems of transparent insulation provide an integrated sunscreen. these integrated sunscreens cause undesired maintenance costs
- the delicate insulation panels have to be incorporated carefully, construction progress often is effected negatively
- there are few specialized companies which can carry out the installation

solarconcrete offers an robust solar element that is cast into the monolithic concrete wall. because of its geometry the solar element does not need a shading system to block summer radiation. a heating/cooling system based on water tubes should be integrated in the wall to provide a control system in case of extreme climate alternations.

solarconcrete cannot be used to substitute a heating system, but it supports the heating mainly during autumn and spring. it is a contribution to save fossil fuels and reduce emissions.

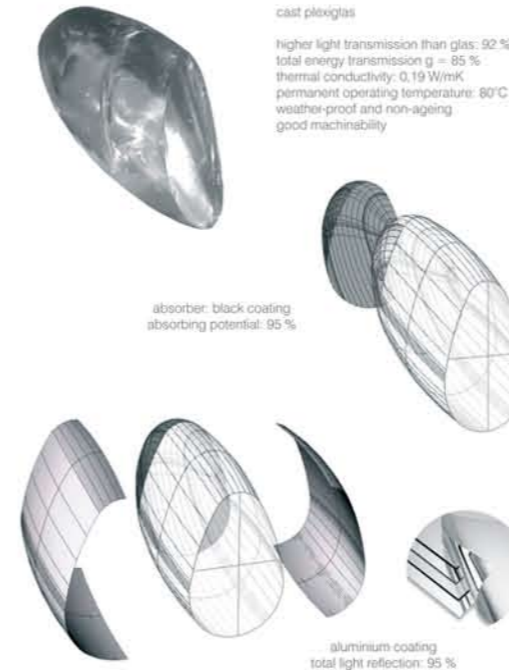


photomontage scale 1:1

rapid prototyping cast model

solarconcrete

materials of the solar element



cast plexiglas
 higher light transmission than glass: 92 %
 total energy transmission $\tau = 85 \%$
 thermal conductivity: 0.19 W/mK
 permanent operating temperature: 80°C
 weather-proof and non-ageing
 good machinability

absorber black coating
 absorbing potential: 95 %

aluminium coating
 total light reflection: 95 %

prototype model



wall construction 1:5



phase change material (pcm):
 Rubitherm GR 27
 - mixed into the concrete compound
 - increases heat storage capacity
 - has a positive effect on the thermal transmission coefficient because of its low thermal conductivity



light-weight concrete: Liapor
 - guarantees thermal insulation
 - 40% aggregate: Liapor
 - fine aggregate: Liapor extruded glass granulate
 - thermal conductivity: 0.33 W/mK

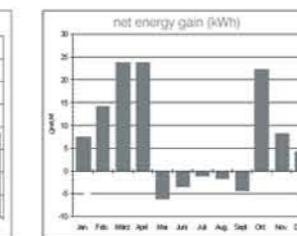
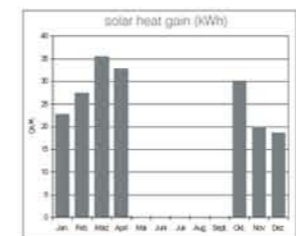


wall construction
 light-weight concrete + soarelement: 7 cm
 light-weight concrete with pcm: 38 cm
 wall cooling/heating

solar gain

solar gain per sqm solar surface (37 elements):
 location Upper Bavaria: 219 kWh/a
 location Chur: 253 kWh/a
 heating period: 1st of october - 30th of april

data based on wallsize d=45cm
 concrete wall: $u=0.65 \text{ W/qm K}$
 concrete + plexiglas: $u=0.56 \text{ W/qm K}$
 total: $u=0.62 \text{ W/qm K}$



transmission and reflection

radiation during heating period: 5° - 40°
 radiation in summer: 40° - 65°

