Team members: Sofia Anagnostopoulou, Sven Finke, Meike Pardey, Ekaterina Starukhina Panagiota Panagiotakopoulou, Grammatiki Dasopoulou, Iro Stefanaki, Vasiliki Katsigianni, Sofia Angeliki Kouvela, Kalypso Mavromati Fofo Kalfa, Eleni Linaki

NEW TYPE OF CERAMIC ROOF TILES

SUSTAINABILITY

Soil + Water = Clay + Fire @900° C= CERAMIC

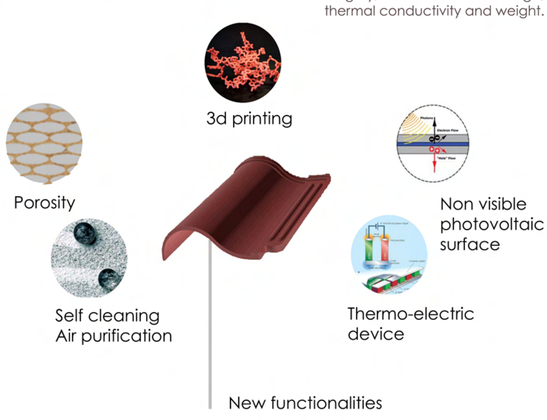
The aim of this workshop is to incorporate aspects of nanotechnology in a traditional building material, such as ceramic roof tiles. Working on aspects in product design and performance of ceramic roof tiles, we have re-designed both the shape and microstructure of the product, in order to produce a new multifunctional material.

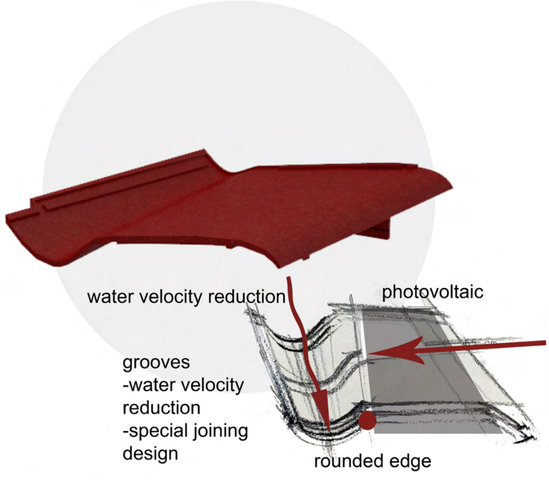
In the context of ECOWEEK workshop, we worked on ceramic roof tiles, a sustainable build-ing material with long history and technological evolution through ages.

Ceramics roof tiles proof their sustainable nature: They made of soil and water (clay), have by default low cost and low environmental impact, since the raw material require minimum elaboration and - compared to cement - they are fired at low temperature. Overall, not only they are sustainable but they are traditional and durable materials, totally recyclable with no toxic by-products.

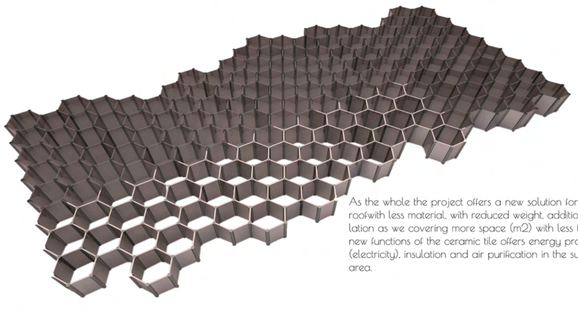
Following a biomimetic approach and working with technological solutions provided by nanotechnology, we produced an innovative product, with additional functionalities such as energy production (photovoltaic and thermoelectric), self-cleaning and air purification properties (photocataly-sis, hyper- hydrophobicity), as well as thermal in-sulation and toughness (design of microstructure at microscale). This approach eliminates any weak properties of the existing roof tiles, such as fragility, enhanced heat storage, thermal conductivity and weight.

NEW PRODUCT



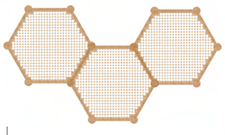


DESIGN in MESOSCALE

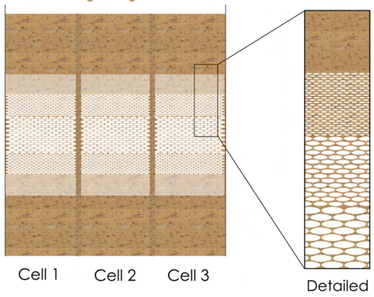


As the whole the project offers a new solution for covering a roofwith less material, with reduced weight, additional heat iso-lation as we covering more space (m2) with less tiles. The new functions of the ceramic tile offers energy production (electricity), insulation and air purification in the surrounding area.

nano + design solutions



6° slope
- self cleaning
- direction of the sun radius



DESIGN in MACROSCALE

The design of this new product was split in three scales: Macro (shape, forms and dimen-sions), Meso (microstructure and layering) and Nano (surface functions and properties). Our inspiration was born from nature patterns e.g. the clay flakes ,honeycombs, tree rims, etc, as well as on the forms and structures that nano-materials create e.g. graphene, nano-silica etc. We propose the creation of an hexagonal unit cell with porosity up to 80%, reducing at the same time fragility. This could be achieved by the use of 3d printer in micro scale. The hexagonal is a stable structure with solid columns which is used to transfer the heat transfer from top to the bottom of the structure.In this way we re able to use thermoelectric element on the bottom side.

In terms of the overall product design, the initial concept came from the S-style roof tiles, by reforming them into a new shape and connectivity. By using the traditional roof tile we overturn its concaveness part and develop grooves so we reduce the speed of the water. In the flat part of the roof tile we apply an organic photovoltaic system. The design of the tile also increase the effective area of photovoltaic which is non visible and do not affect the aesthetic parameter.

This project was aiming to encourage collaboration with architects and material scientists for the development of new sustainable and functional building materials.

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