

Novel type of façade-window solar thermal collector

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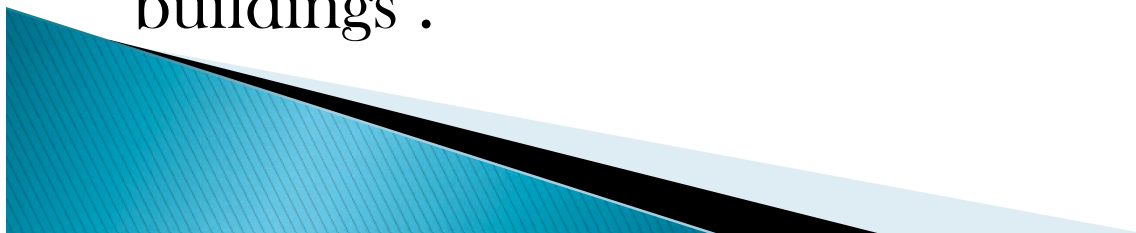
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Architectural integration of façade collectors in buildings

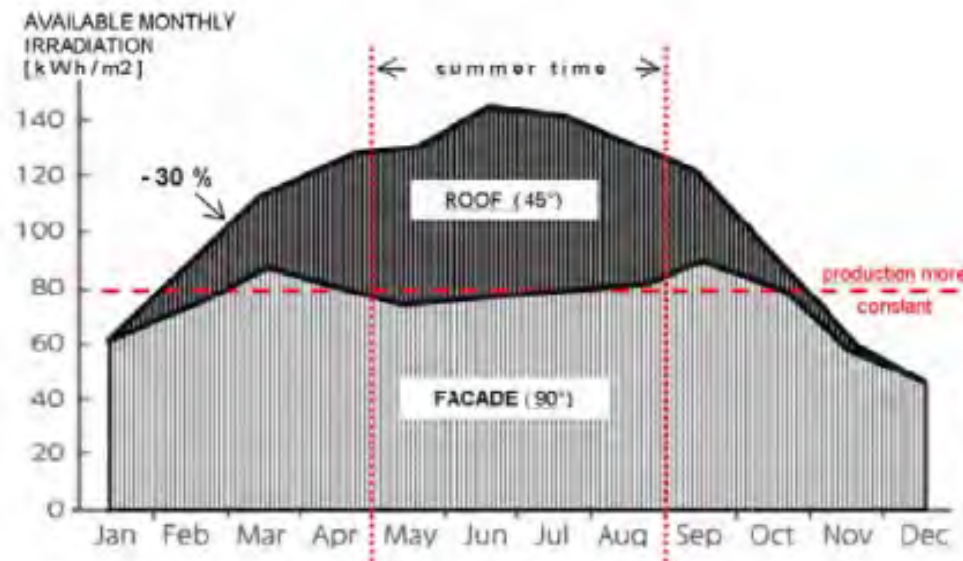
- Usually, architects are mainly focused on a good appearance of the building,but they should accept a new way of thinking for building designs where beside the architectural appearance, the energy efficiency of building is most important.
- Heating and cooling must be included in the architect concept for building project.
- **Solar energy** has the biggest comparative advantages – it is the most ecological energy and could be used not only for sanitary water heating as well as for space heating of buildings .



Angle of installation of façade collectors in buildings

Question from the solar experts?

Angle of façade collectors compare with angle of roof installation ?



Roof versus facade collector annual yield pattern

Motivation

- ▶ Solar space heating, solar cooling needs big surface to collect solar irradiation
- ▶ Big buildings have only a relatively small roof surface
- ▶ One way out are solar thermal façade collectors
- ▶ What kind of façade collectors? Humidity issues? Welding lines? Waves?
- ▶ Architectural engineers, designers, end userswill accept only esthetical façade collectors which will be integrated in façade and which will not destroy their appearance after installation and after exploitation – long term stability .



Introduction

- ▶ Most of the quality certificates of solar thermal collectors and their components are based on characterization and tests after their production: excellent optical characteristics and very good efficiency,
- ▶ But during and after exploitation , decreasing of efficiency or esthetical appearance usually starts already after their installation: Air and humidity - enables corrosion of the absorber; especially in welding lines as result of classical welding , temperature shocks- different thermal expansion of Al sheets and Cu pipes,.....



Standard ways of absorbers welding



(a)

(a) ultrasonic absorber welding;



(b)

b) laser absorber welding

NOTE: Both of them have destroyed selective coating on the front side.

Novel CS-welding type



(a)



(b)

CS new type of absorber a) Font side; b) Back side

This new type of welding does not have destroyed selective coating ,no welding lines,
no waves similar with collared glass !

Novel CS absorber *assembled in:*

- a) standard flat collector, and
- b) new type of window module

humidity issues are overcome !



(a)



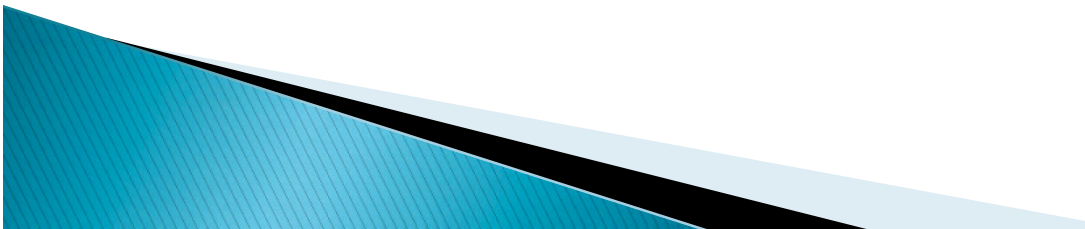
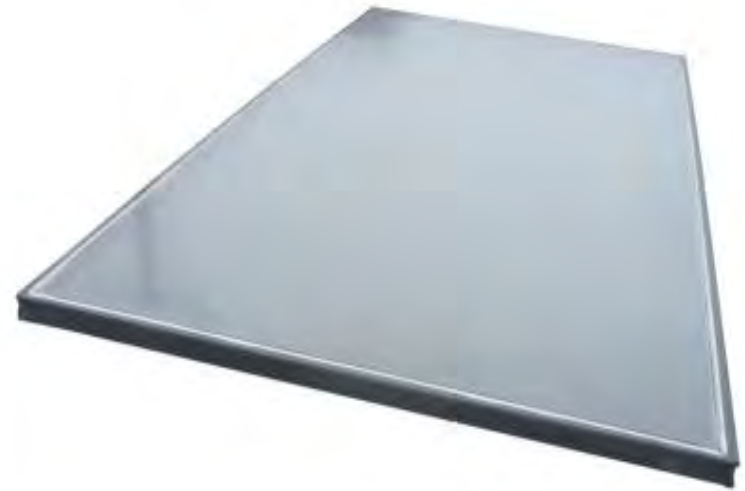
(b)



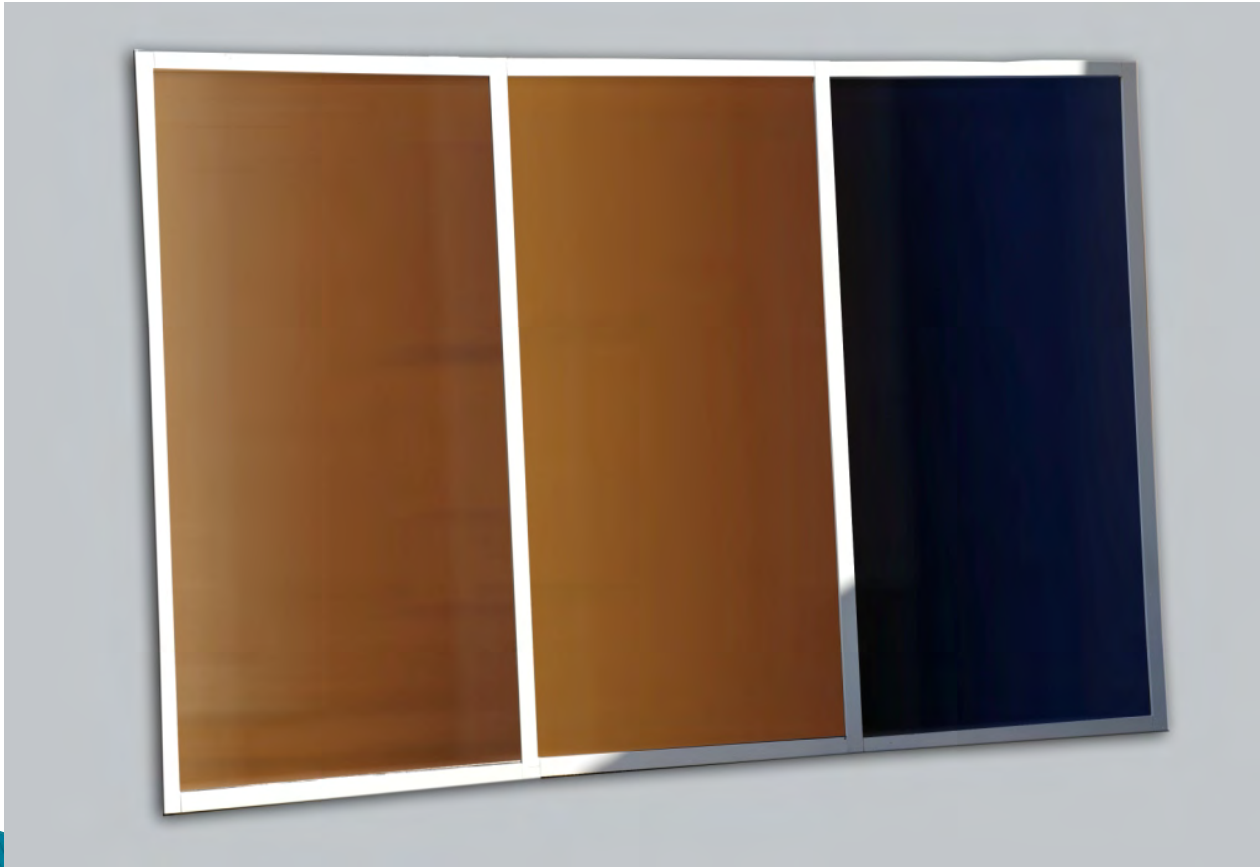
(c)

Window module collector

- ▶ Between two glasses is inserted new type of CS-absorber and sealed with special adhesive
- ▶ the humidity issues are overcome



Novel window module assembled and installed in different frames



Novel CS window module :

- good architectural appearance

Installed window modules in
the existing window frames of CS building





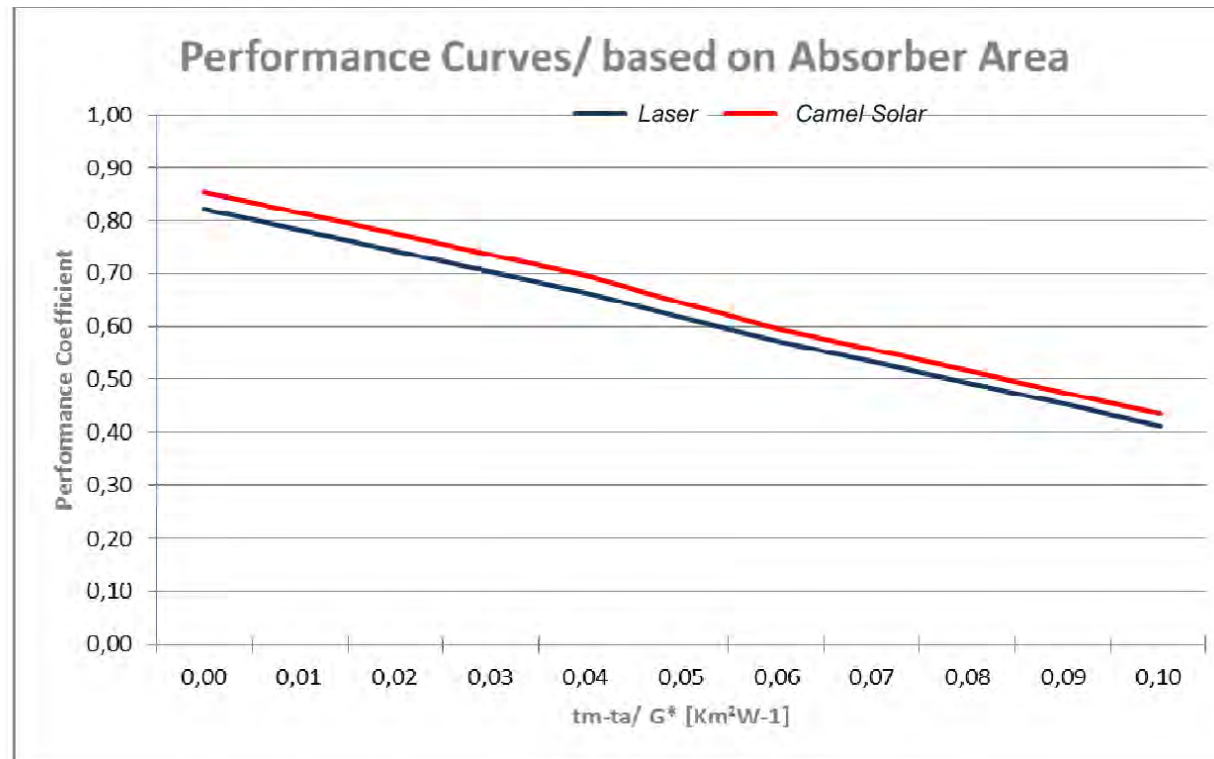
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Application of CS-window module

- ▶ New CS window module provides a good architectural appearance, long term stability and a very good efficiency
- ▶ Could be assembled in standard flat plate collector and in window frames.
- ▶ Humidity problem is overcome.
- ▶ From architectural aspect the building will have facade consisting of coloured window glasses.



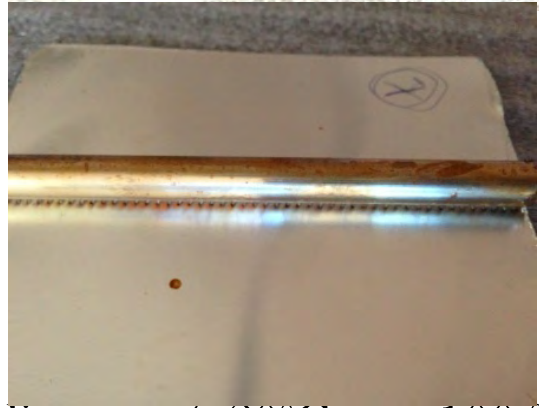
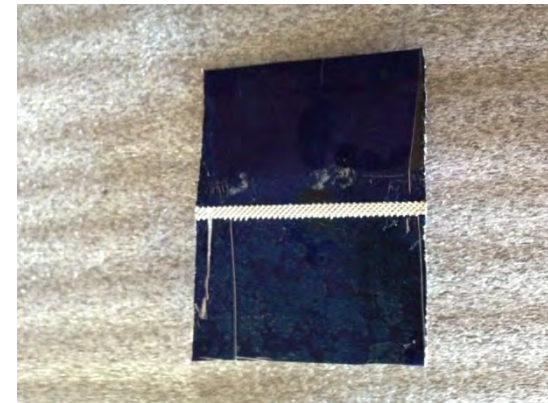
Comparison of efficiency of the new CS - absorber with standard laser welded absorber



The new CS type of absorber has 7 to 8 % better efficiency compared to efficiency of laser welding absorber !

New type of CS Absorber

- thermal/humidity test of different types of absorbers



Cyclic shock humidity tests (-20°C to $+100^{\circ}\text{C}$) on absorbers with:

(a) CS- welding;

(b) laser welding;

(c) ultrasonic welding

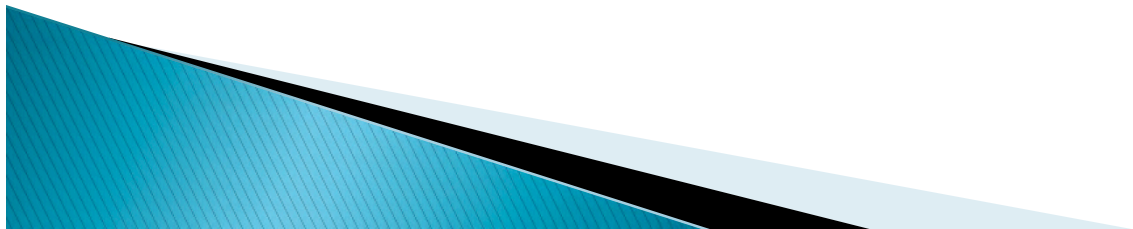
The less attack on the selective coating is observed on the novel CS-

type
welding and ultrasonic welding
are corrosion and oxides

On the back side, laser

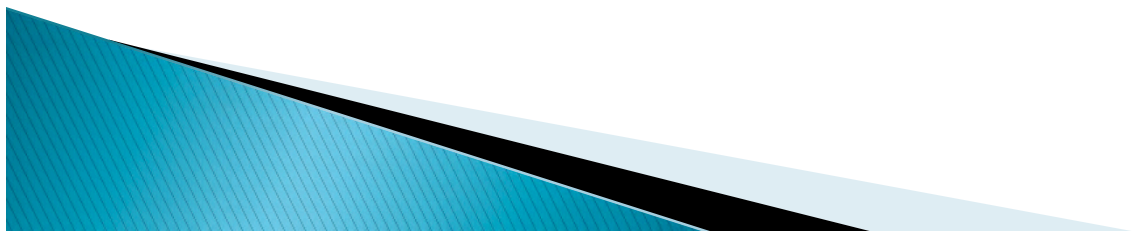
Results and Discussion

- ▶ Optical characteristics are nearly the same after humidity testing and visually it is not possible to see any damage on selective coating.
- ▶ Temperature shocks show that welding lines keep nearly the same contact and heat transfer.
- ▶ Corrosion at the contacts is not visible.



Conclusion

- ▶ New type of window module shows not only a good architectural appearance, but also a good stability and efficiency over a time.
- ▶ The selective coating is not degraded;
- ▶ The modules are without any humidity that is one of the most degradable factor for the absorber and of the collector efficiency.
- ▶ Investigations will continue...

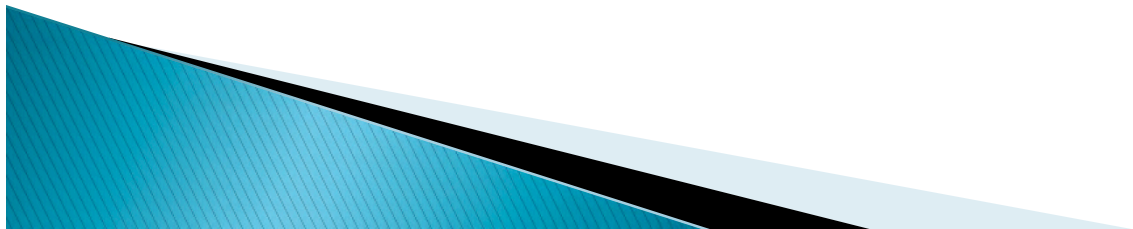


Future of solar energy in architecture

- ▶ Future of solar energy in architecture will be not in installation of solar thermal collectors in façades and windows, but in assembling of components : absorbers, tubes ... in façade walls or in windows.
- ▶ They must be completed before montage, as modules.
- ▶ They will be montage from building companies during façade and window installation in one step.
- ▶ Glasses, isolation , frames will be used once not two times
- ▶ So, they will be cheaper, faster and acceptable form by architects, designers, building companies ,..end users.
- ▶ In the other way, solar thermal competitions : biomass, heat pumps, PV, will be implemented instead of solar thermal.

Acknowledgements

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Thank You for your attention !

