BE-SMART

Together for Active and Efficient Buildings

The BE-Smart project has received funding from The European Union's Horizon 2020 research and innovation programme under grant agreement No 818009.

Multifunctional EPoGs - Colourand multi-functionality

1. Aesthetically attractive and reliable Energy Positive Glazing (EPoG).

2. Evaluate and develop colouring solutions

3. Multi-functionality

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Aesthetically attractive and reliable Energy Positive Glazing (EPoG)

Standard c-Si modules

Typical ground installation

Typical building installation

- Market share of Si wafer-based PV modules in 2020: > 95%
- Appearance: dark blue to black colour, standard unit dimensions

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Aesthetically attractive and reliable Energy Positive Glazing (EPoG)

Standard c-Si modules

Typical building installation

Multi-functional EPoG elements

- Multiple module colours, patterns/images possible;
- Multiple module dimensions;
- Multi-functions: thermal insulation, acoustic barrier, Surface self-cleaning, Self-heating

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Comparison on the currently available colouring techniques for EPoGs

Technology	Extra cost (compared to standard PV modules)		Aesthetic				Lifetime	Power
	Raw Mat.	Process	Color	White	Image	Pattern		
Colored encapsulant								
Interferential filter								
Laminate Interlayer (Mesh/fabric)								
Laminate Interlayer (PET Based)								
Digital Interlayer (PET based)								
Digital Printing (non ceramic)								
Digital Printing (ceramic)								
Ceramic fritting								
Enameling								
Fused pigments								
Symbol explanation								
Least advantageous	2	3	4	5	Most advantageous			

- Wide range of selections with pros and cons of each;
- Selection of colouring techniques depends on the specific needs of the project;
- Cost should be considered within the scope of the total EPoG system cost

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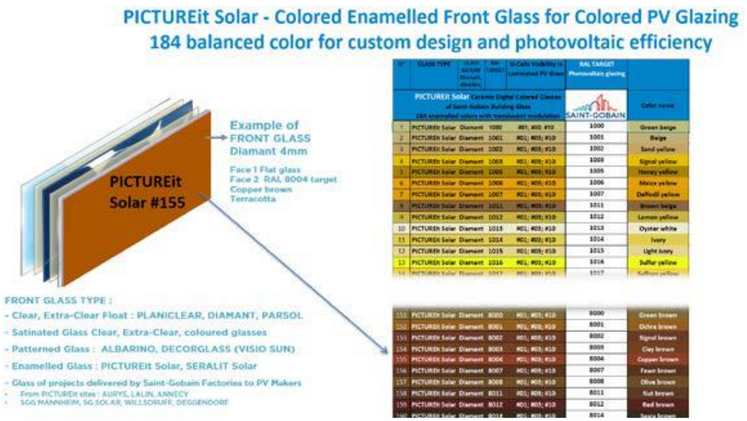
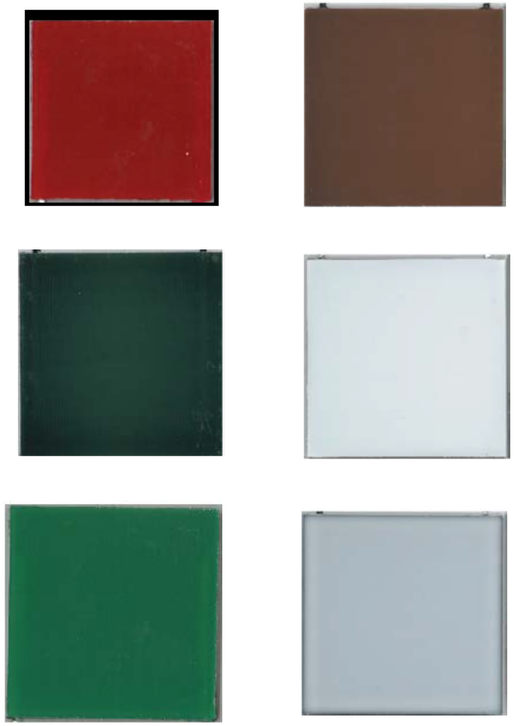
Examples of colour development in Be-smart

Coloured enamelled glass



Coloured encapsulant



Coloured Solaxess filtre

- All 3 techniques are commercially available;
- Portfolio of different colours in expansion;
- Colour matching to a customized colour is a challenge

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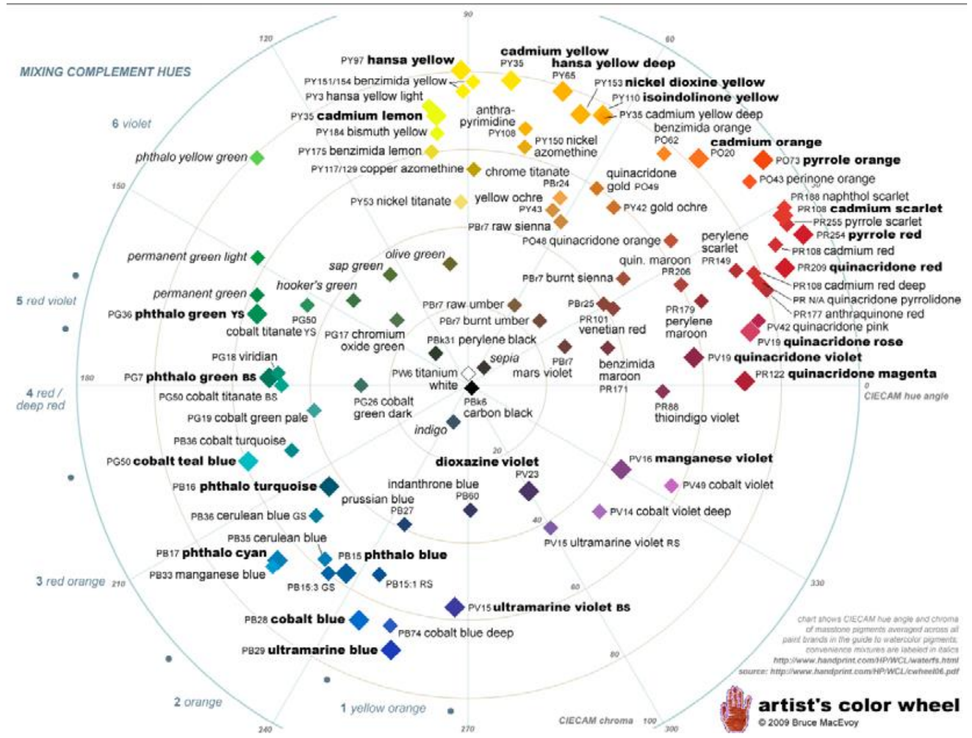
Software for colour matching of EPoG elements



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Colored EPoG

- Multiple Actual colour of EPoG: colouring element imposed onto the colours of standard c-Si modules
- Challenge to match a customised colour using traditional software

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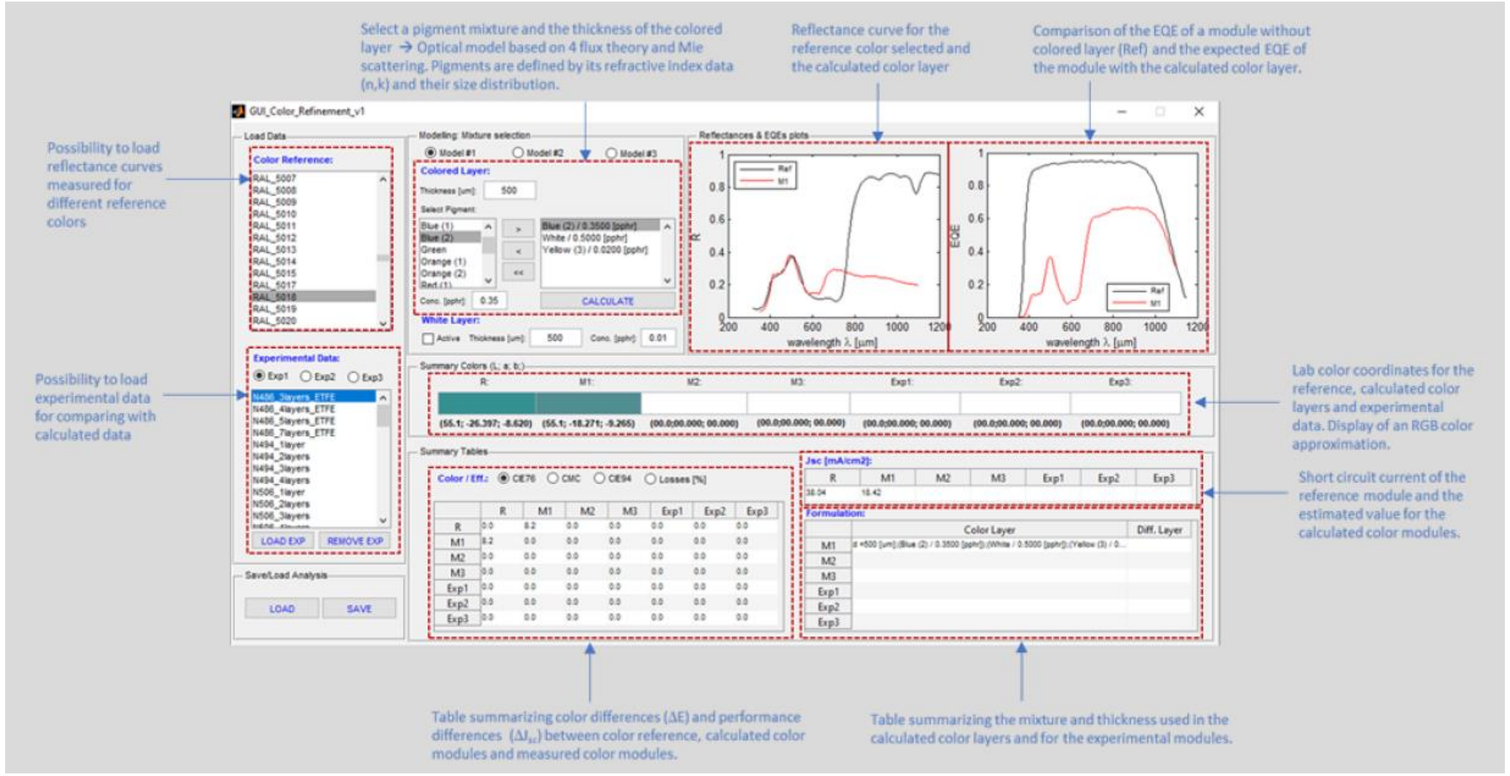
Software for colour matching of EPoG elements



- Software specially developed for coloured EPoG: based on 4 flux theory and Mie scattering;
- Expanding pigment database;
- Recipe proposal for the targeted colour;
- Prediction of module power loss after colouring

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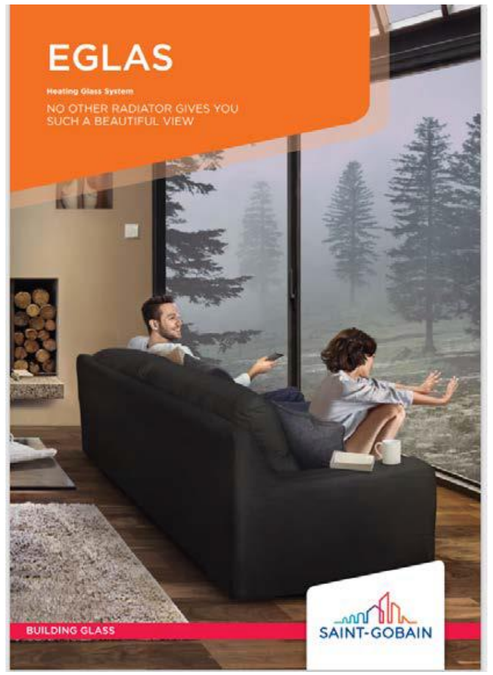
Multi-functionality of EPoG elements



TIMELESS-anti-corrosion glass

- EPoG element: an integrated part of building skin
- Top functions of building facade: water ingress; control of air permeability; Resistance of wind load; Thermal/acoustic insulation; solar gain; Aesthetics.
- In Be-smart: self-heating, self-cleaning, anti-corrosion

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Thank you for your attention.