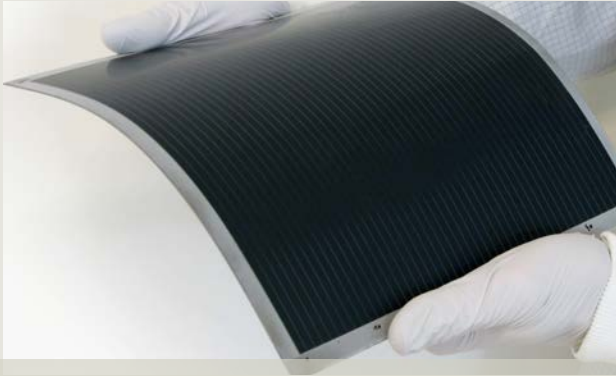


// ZSW PV Materials Research: Non-Glass Substrates

CIGS-based solar cells on cost-effective substrates



// Flexible solar module on enamelled steel substrate



// Thin polyimide film used in ZSW web coater at low temperatures



// Monolithically integrated mini-module on insulated, stainless steel substrate with an efficiency of > 10 %

Research & development of novel substrates:

- // Mild steel foils with various anti-corrosion coatings for roll-to-roll processing
- // Enamelled metallic substrates (sheets and foils) for CIGS high-temperature deposition, including absorber doping via the enamel layer
→ **Status: > 18 % cell efficiency**
- // Investigation of various thin polyimide films for CIGS low-temperature processing

Buffer layers:

- // Inline and vacuum-deposited Cd-free buffers
→ **Status: > 18 % cell efficiency on glass substrates**

Monolithic cell interconnection on non-glass substrates:

- // Development of dielectric barrier layers for metal substrates; goal: fabrication of monolithically integrated modules on cost-effective metallic substrates such as low-carbon steel
→ **Status: > 10 % mini-module efficiency**
- // Patterning of back contact, absorber and window layers via pico- and nanosecond laser
- // Roll-to-roll laser patterning of the back contact (P₁)
→ **Status: 10 % mini-module efficiency on polyimide film; > 15 % efficiency on enamelled steel**

Flexible encapsulation:

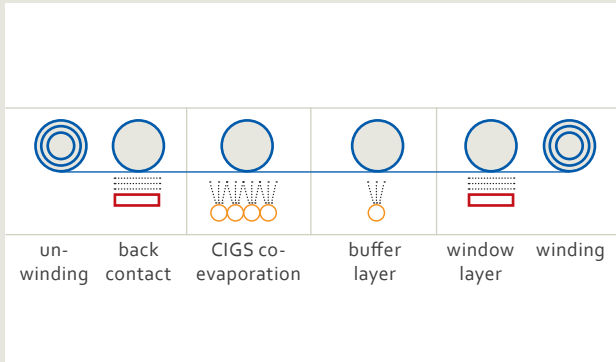
- // Investigation / development and testing of cost-effective, optically transparent barrier layers against water and oxygen transmission

Contact

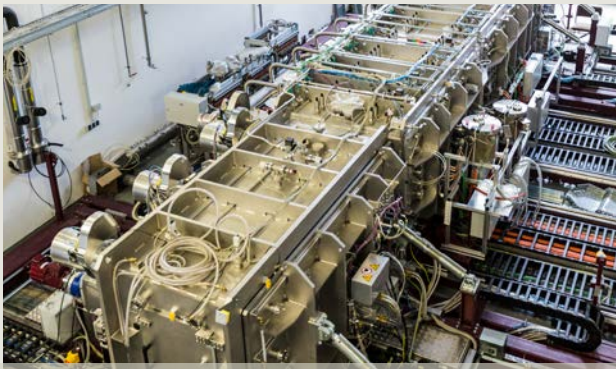
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// ZSW PV Materials Research: Non-Glass Substrates

Roll-to-roll deposition of CIGS solar cells



// Schematic view of the R2R web coater at ZSW



// The R2R web coater for CIGS deposition at ZSW



// Winding unit of the R2R web coater at ZSW

Characteristics:

Integrated (all-in-one) vacuum-based R2R-reactor, including back contact, absorber, buffer and window layer deposition: same vacuum, only one unwinding- and winding unit

Features:

- // Reactor length: 12m
- // sputtering on the roll
- // CIGS coevaporation via free span and bottom-up
- // horizontal tape run, coating in both web transport directions possible
- // deposition both onto metal and plastic webs
- // current operation: polyimide or stainless steel web, thickness: 25 μm – 50 μm , web width: 30 cm

Developments in progress:

- // cadmium-free vacuum buffer
- // multistage CIGS evaporation for enhancing efficiency
- // investigation of alkali metal supply methods
- // R2R laser patterning of the back contact

Contact

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