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Thin film solar modules (CIGS technology) on insulated steel substrate in R2R production for their integration into roofing elements

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In the frame of LIFE-PHOSTER project, which aims at developing new solar technologies and products with low environmental impact, we develop thin film solar modules (CuInGaSe2 or CIGS technology) on insulated steel substrate for their integration into roofing elements. To do so, we have designed and built roll-to-roll pilot lines, dedicated to wet and vacuum dry coatings in a clean room environment, constituting a unique combination of pilot lines for the functionalization of steel substrate.
Thin-film CIGS solar cells are diodes composed of two semiconductors: p-type CuInGaSe2 absorber layer and n-type buffer layer (such as ZnMgO), sandwiched in between Mo-based back electrode and ZnO:Al top transparent electrode. Moreover, when laser-patterned, these cells can be directly assembled into mini-modules with tunable voltage and current. This technology, already industrialized onto glass substrates, has been implemented onto functionalized steel substrate in the frame of the PHOSTER project.
The functionalization of steel substrate is done through wet deposition techniques while the completion of solar cells is a succession of vacuum based-dry coatings. These prototypes present similar features, making their combination quite unique:
- Possibility to treat steel coils up to 200 mm in width and with thicknesses ranging from 0.05 mm to 0.4 mm
- Speeds ranging from few mm/minute up to several m/min
- Modularity in the implementation of the processes, making possible to realize depositions in any order
These two prototypes are combined with a third one called SELENIZATION line, enabling to thermally treat the deposited layers under selenium atmosphere in order to turn them into a photoactive CIGS one. Significant achievements have been obtained on the prototypes with the completion of solar cells and mini-modules.

Keywords
GIGS
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