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Micromorph and polymorphous solar panel in a warm temperature transitional climate - comparison of outdoor performance and simulations

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Abstract

The publication contains polymorphic andmicromorphic photovoltaic module outdoor tests performed during autumn, winter, spring and summer day. Simulations of an installation consisting of panels both types have been made. Both performances were compared for the location in the Kraków-Częstochowa Upland, continental climate.

Location and technical conditions

The measurements were carried out in the Education and Research Centre for Renewable Energy Sources and Energy Conservation at the AGH University of Science and Technology in Miękinia, Małopolskie Voivodship, Poland

panel	SN2-130.0, Sontor,	GSP6-240-SI60, German Solar
P_{max} [W]	130	240
I_m [A]	1.64	8.05
U_m [V]	97.2	29.80
I_{sc} [A]	1.62	8.56
V_{oc} [V]	127.1	37.4
temperature coefficient of P_{max} [%/°C]	-0.44	-0.40
temperature coefficient of I_{sc} [%/°C]	-0.334	-0.39
temperature coefficient of V_{oc} [%/°C]	0.069	0.07

Location of panels on the frame
(1) micromorphous
(2) polymorphous

Table 1
Basic panel parameters measured in STC

Results

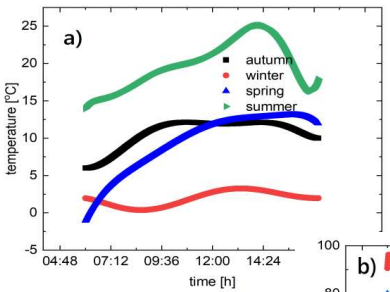
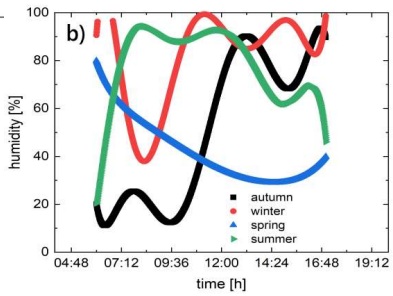


Figure 1. a) Temperature and b) humidity variations over the investigation days



The measurements were taken during the day during the four seasons - autumn, winter and spring, summer. The measurements were taken from 2019 to 2020 (8th November - autumn, 20th February - winter, 21st April - spring and 18th July - summer).

Acknowledgement

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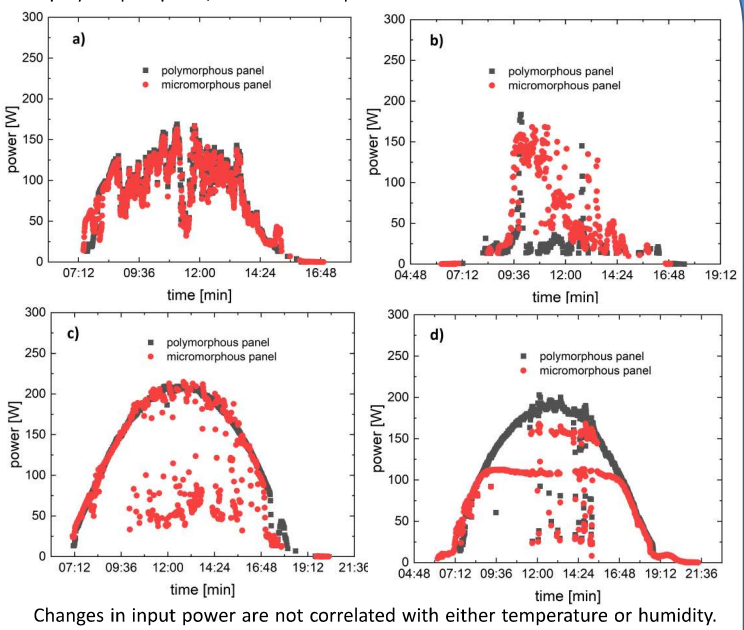
Figure 2. Daily characteristics of the panel power during the day a) autumn, b) winter c) spring d) summer The time colour means the waveforms for the polymorphic panel, red - micromorph



Changes in input power are not correlated with either temperature or humidity. However, we may hypothesize that the power output is strongly influenced by varying clouds. Definitely higher power values are obtained in the summer day analysis. The power output signal on both cells is similar for both cells.

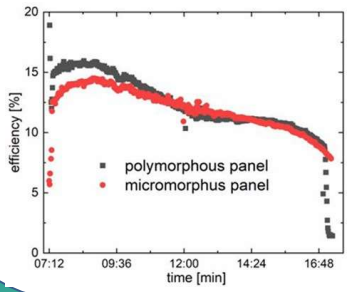


Figure 3. Efficiency comparison for panels during a daytime

Large changes in the drop in performance of the micromorphic panel are observed only on the spring day. These changes can only come from selective shading of the micromorphic panel.

Table 2. Maximum power generated. For the installation simulation it has been converted to 1 panel

Power [W]	outdoor performance		simulations	
	Micro-morphous	Poly-morphous	Micro-morphous	Poly-morphous
autumn	150	150	100	130
winter	150	150	75	80
spring	200	200	100	140
summer	100	200	100	180

Conclusion The paper presents executive tests of panels in real conditions. The performance of photovoltaic installation was also simulated. The aim of the study was to determine the changes in efficiency during the year under sunshine conditions at different seasons of the year during the day. For the micromorphic cell, the actual (outdoor) values turned out to be more favourable than the values obtained by simulation with the Polysun program. The increase in maximum power achieved was twice as high in winter and spring, while in autumn the actual values were 50% higher. In summer, simulation and measurements showed the same value. In the case of the polymorphic panel also the maximum powers are higher for outdoor performance. In this case, the significant change is only in the spring season (about 30%). In the other cases, the difference is 5-20%.