

Effects of Heat Accompanied by High UV on Lifetime of c-Si PV



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PROBLEMATIC:

The harsh climatic conditions of desert as heat, high ultraviolet, dust, and sandstorms considered one of the major challenges related to the photovoltaic deployment. Under these extreme conditions, the PV modules find themselves under UV stress accompanied by high temperature that will lead some modules to exhibit significant degradation within a few years fielded. The heat combined with high solar irradiation affect the PV module and will accelerate aging encapsulant materials, causing yellowing and/or browning discoloration. The change in color affect the performance of the module negatively.



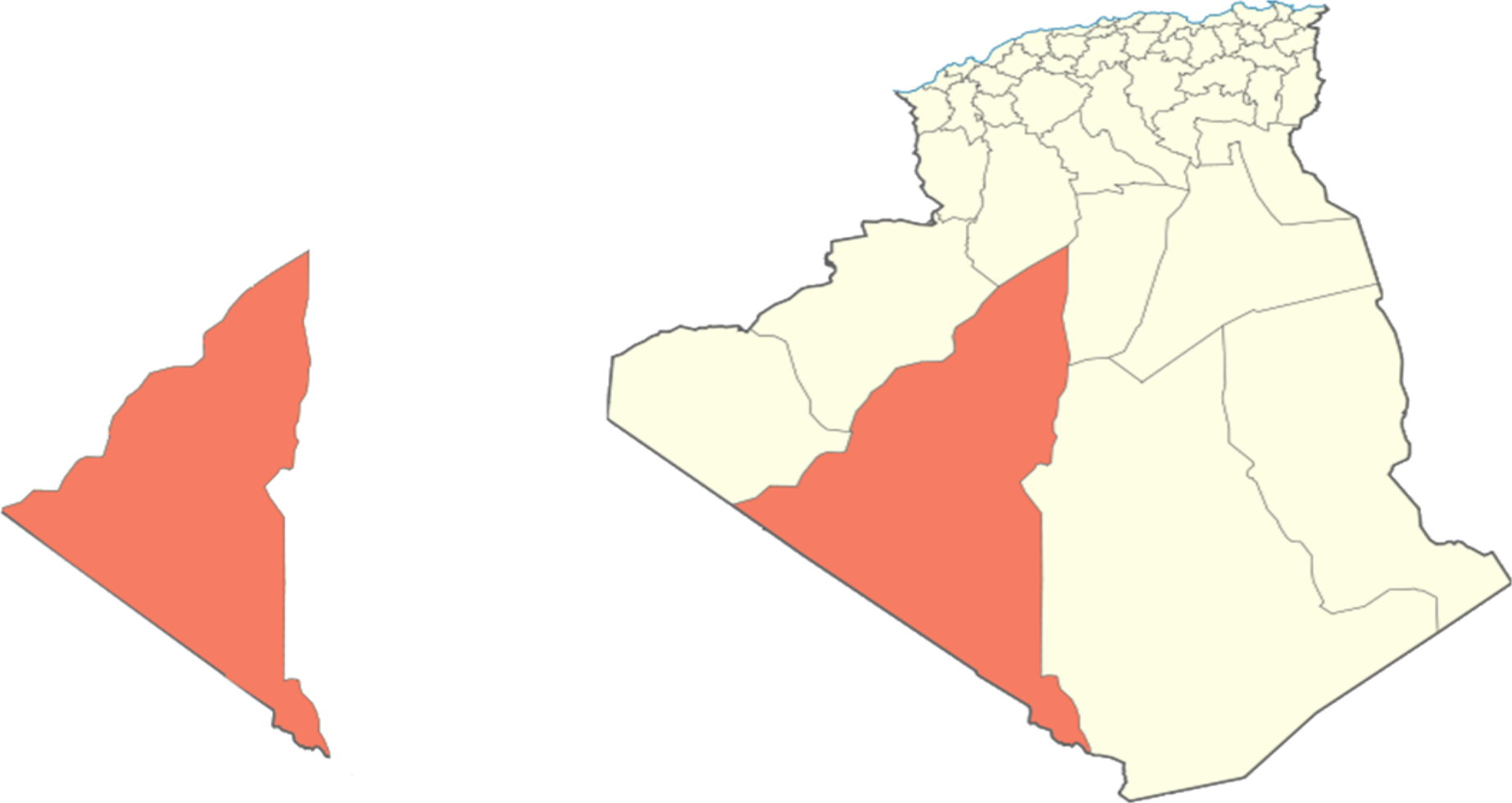
ENVIRONMENTAL CONDITIONS DEGRADING THE PERFORMANCE OF C-Si IN HOT DESERT CLIMATES

Desert, present the most difficult environment for PV modules. In desert climate, PV modules are globally exposed to a different set of external stresses such as high temperature, ultraviolet radiation, sandstorms etc ... That will be affect their efficiency and lifetime.

the most common failure mode observed in desert environment is discoloration of the EVA encapsulant, discoloration is caused by a combination of climatic factors such as High temperature, and the intense presence of ultraviolet radiation . The EVA discoloration is the change of the original color of the material, occurring variation in color from yellow to brown, passing in the dark brown color . The change in color affect directly the performance of the module.



Experimental results carried out at Research Unit in Renewable Energy **URERMS**. Adrar which is a region situated in the southern-west of Algeria (Latitude 27.88_N, Longitude _0.27_E, Altitude 262 m).



Hot desert climate:

The region is characterized by high UV levels specifically in the summer season and high ambient temperature with long and high exposure periods (as illustrate in fig 1). The desert climate is extremely hot, dry, and expressing very pertinent thermal variation between day and night.

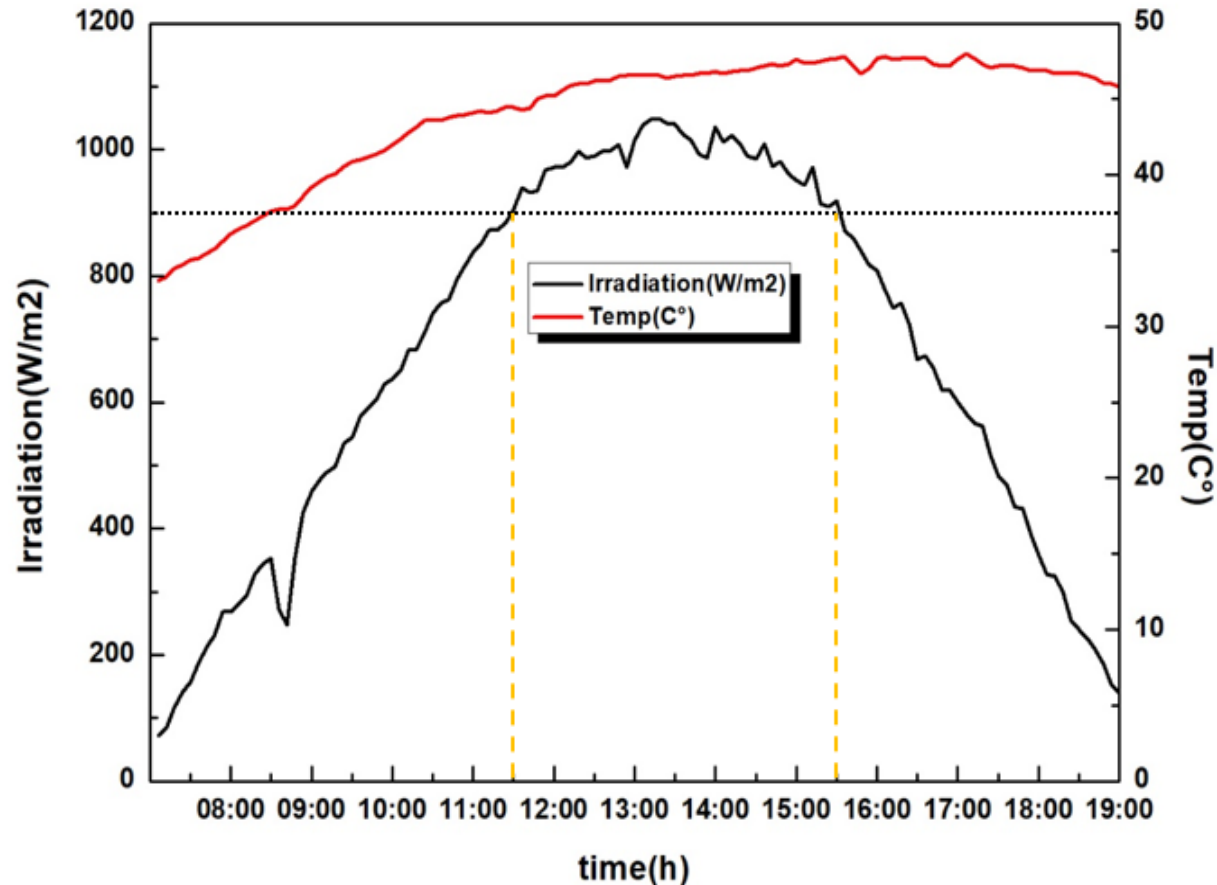


Fig 1. Daily irradiation accompanied by temperature in July in Adrar.



The main degradation mechanism in photovoltaic modules in Saharan climate is the physical change of the encapsulant, highlighting by discoloration (“**yellowing**”, “**browning**”) illustrates in figures below.



Fig .2 Discoloration of the EVA “Browning”.

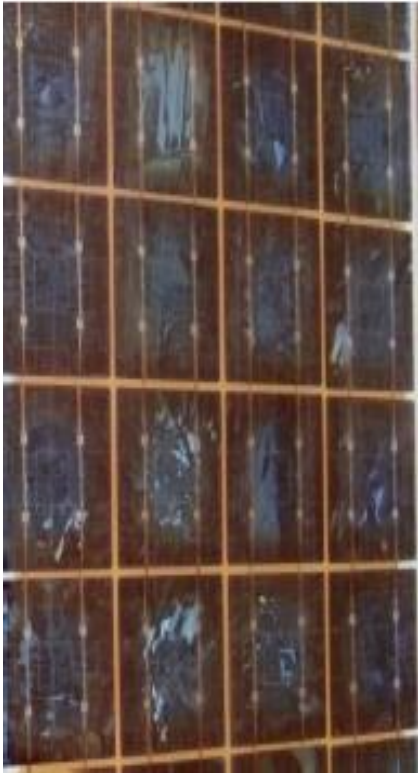


Fig .3 Discoloration of the EVA “Yellowing”.



CONCLUSION

- The desert is a particular region that poses several challenges for PV solar energy.
- Heat accompanied by high UV irradiation responsible for the aging of the encapsulant (EVA) highlighting by **yellowing** or **browning** .
- This study can be beneficial in further studies on degradation of PV modules, design of PV modules and choice of materials .

