


Chapter 9

Understanding the Impact of Moroccan Weather on the Durability of Solar Mirror: A Comprehensive Review

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ABSTRACT

The aim of this chapter is to provide an up-to-date overview of research into the durability of solar mirrors in different Moroccan environments. Taking into consid-

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eration numerous studies carried out in different regions of Morocco, the synthesis identifies the complex combination of environmental factors, materials, and ageing mechanisms that shape the performance of solar mirrors in concentrated solar power (CSP) applications. In particular, the research highlights the critical impact of geographical location, climatic conditions, and material choices on mirror degradation. The varied nature of paint degradation, the potential of protective coatings, and the importance of rigorous testing procedures are highlighted. This review summarizes the results, highlighting the importance of Moroccan research in advancing CSP technology in the context of renewable energy development.

1. INTRODUCTION

Solar energy represents a cost-effective solution to renewable energy, and Morocco aims to change 52% of its consumption to renewables by 2030. To achieve this transition, Morocco is in the process of various solar investments and developing solar technology at various sites and in a range of climates. For solar technologies to be successful, a key component will be the strategic siting of solar plants to maximize solar resource potential. However, all of these solar developments complicate the sustainability analysis of solar power plants due to the challenges imposed by environmental conditions (i.e., temperature, irradiation, wind, dust, precipitation, humidity, and salinity). In a laboratory, all materials used in solar power plants have been subjected to accelerated testing; however, the interaction between these environmental factors under real-life conditions complicates our understanding of their role in durability and efficiency characteristic of an array of solar mirrors (Lakhouil et al., 2023).

Studies have established that regions with high levels of Direct Normal Irradiance (DNI), like the Middle East and North Africa (MENA), often experience high aerosol concentrations (Karim et al., 2014a; Karim et al., 2014b). This study seeks to understand the potential challenges solar mirrors are exposed to in this environment, including erosion from wind-borne sand particles, chemical degradation from corrosion, and surface fouling that is an unavoidable by-product in arid climates amongst others. This research aims to understand the spatial and materials attributes of solar reflectors to address wind speed, temperature, humidity amongst other climate impacts on erosion and soiling, to be able to provide a rationale for solar mirror design and maintenance in such conditions. Due to the potential impact of solar reflectors longevity on financial and operational performance of solar photovoltaic plants, this study focuses on the behaviour of the physico-chemical properties of monolithic glass mirrors and their paint coatings and protective layers (Lakhouil et al., 2023). This study assesses the stress factors of temperature,

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