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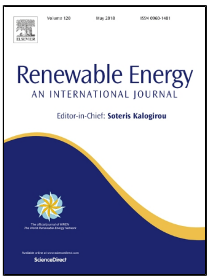

Effectively predict the solar radiation transmittance of dusty photovoltaic panels through Lambert-Beer law

Li Xingcai, Niu Kun

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Effectively predict the solar radiation transmittance of dusty photovoltaic panels through Lambert-Beer law

Li Xingcai[1,2]* Niu Kun[1,2]

[1]School of Physics and Electronic-Electrical Engineering, Ningxia University, Yinchuan, 750021, China

[2]Ningxia Key Laboratory of Intelligent Sensing for the Desert Information, Ningxia University, Yinchuan, 750021, China

*Corresponding author: nxulixc2011@nxu.edu.cn

Abstract: Due to the instability and unsatisfactory prediction of the generating capacity, the photovoltaic power is hard to directly connect to the electric grid. Dust deposition is one of the key impact facts for the photovoltaic power, but its effect cannot be predicted through a reasonable physical model, and it became a hot research topic. This paper proposed a comprehensive physical model to predict the impact of the deposition on the light transmittance of solar panel. This model involves some physical parameters of the deposition, which made it applicable widely. In addition, the results indicate the influence of deposition prominently increased with the raise of the concentration and the size of the particles, but decreased with the changes of particle diaphaneity.

Key words: dust deposition density, photovoltaic cell, light transmittance, physical model, electromagnetic scattering

1 Introduction

Energy is the material base for the survival of humanity, and an important resource for the sustainable development of economy. Green power, not only can offer a clean, very abundant energy for the continuously increasing energy demand, but also can make significant contributions in solving some of the environmental and energy problems faced by the world[1-3].The most widely used green energy source is the photovoltaic power[4]. However, because of its some disadvantages, photovoltaic power would not be readily applied in the power grid, which lead to a serious abandoned phenomenon in some areas[5]. The accuracy of forecasting the new energy power affects the capability of the grid-connected electrical system and the grid-connected entrance system [6, 7].

In general, solar irradiation and air temperature have more significant impact on the output power of solar cells[8]. The dust particles existing in the air can deposit on the surface of a photovoltaic module, and create a dust layer on it, which lead to a negative effect on the valid solar irradiation of solar cells[9, 10]. Therefore, some researchers have carried out studies on the influence from dust, soiling, and so on [11-13]. For