

积灰对太阳电池组件输出特性的影响

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摘 要

我国西北部辐照资源丰富，地域开阔，集中式光伏并网电站技术得到很好发展，但在这些地区，光伏电站的发电效率由于受到积灰等因素的影响，其效率大幅下降，造成了巨大的经济损失。所以，对于无人或少人维护的大型集中式光伏电站，要想保证其稳定的发电效率，就必须了解积灰对其发电功率的影响因素。国内光伏电站只对太阳电池组件安装角度跟积灰沉积量的关系进行了研究，而对于太阳电池组件安装的最佳倾角对积灰沉积量的影响鲜有报道。

本文通过积灰对于太阳能光伏组件发电效率的影响因素进行分析研究，通过研究表明，光伏组件的输出功率受沉积在光伏组件表面的灰尘影响，并随着积灰密度的增加，光伏组件的输出功率会快速降低。当积灰密度到达一定值时，输出功率的减少率会逐渐缓慢。此外风，降雨强度，灰尘性质，安装倾角等对积灰的形成及光伏发电转换效率也有一定影响。通过实验表明，当超过 5mm 的降雨量时电流会损失约 5%，此外，积灰的温升效率也非常显著，附着在光伏组件表面的积灰会使其形成保温作用，使组件自身的温度逐渐上升，从而造成太阳电池组件的输出功率降低，每当晶体硅太阳电池的温度上升 1℃，其输出功率约下降 0.5%。通过综合分析得出，积灰会使太阳电池组件的综合转换效率降低至 17%，严重的甚至将整个太阳电池组件损坏；本文以呼和浩特地区某电站对安装倾角分别为 0°、10°、20°、30°、40°、50°、60°、70°、80°、90°，几何尺寸均为 50mm×40mm×5mm 的 10 块光伏组件的实验研究数据为基础，通过建立数学模型得出光伏组件的在存在积灰时的实际输出功率、太阳总辐照度、积灰量和积灰影响指数之间的关系，通过比较积灰影响指数的数值大小得出该地区光伏组件面板的最佳安装倾角为 50°。

关键词：积灰；光伏发电系统；输出影响；最佳倾角

Title: Effect of Ash Deposition on Output Characteristics of Solar Cell Modules

ABSTRACT

The northwest of our country is rich in radiation resources and has a wide area. The technology of centralized photovoltaic grid-connected power stations has been well developed. However, in these areas, the efficiency of photovoltaic power stations has been greatly reduced due to the influence of dust deposition and other factors, resulting in huge economic losses. Therefore, in order to ensure stable power generation efficiency of large-scale centralized photovoltaic power plants that are not maintained by people or few people, it is necessary to understand the factors that affect the power generation by ash deposition. Domestic photovoltaic power stations have only studied the relationship between the installation angle of the solar cell module and the amount of deposited ash, but there are few reports on the influence of the optimal installation angle of the solar cell module on the amount of deposited ash. In this paper, the influence factors of dust deposition on the power generation efficiency of solar photovoltaic modules are analyzed and studied. The results show that the output power of photovoltaic modules is affected by the dust deposited on the surface of photovoltaic modules, and with the increase of dust deposition density, the output power of photovoltaic modules will decrease rapidly. When the ash density reaches a certain value, the reduction rate of output power will gradually slow. In addition, wind, rainfall intensity, dust properties, installation inclination angle, etc. also have certain influence on the formation of accumulated dust and photovoltaic power generation conversion efficiency. Experiments show that when the rainfall exceeds 5mm, the current will lose about 5%, in addition, the temperature rise efficiency of ash deposition is not the same.

KEYWORDS:Ash deposition; Photovoltaic power generation system; Output impact; Optimum inclination

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