

Can Black Diamond be used as a solar energy absorber?

In any case, the most immediate application of black diamond, especially in its high-defect-density but large-area low-cost polycrystalline form, is as a competitive high-temperature radiation absorber for solar thermodynamic conversion, due to a solar absorptance larger than 90% and high thermal resistance.

What is double black diamond solar?

Once operational, according to Swift Current Energy, Double Black Diamond Solar is expected to be the largest solar project east of the Mississippi River. The tax equity financing makes use of energy communities and domestic content adders, provided in the Inflation Reduction Act.

Can Black Diamond be used as a Photon-enhanced thermionic emission cathode for solar concentrating systems?

The optical and photoelectronic outstanding results open the path for future application of black diamond as a photon-enhanced thermionic emission cathode for solar concentrating systems, with advantages of excellent electronic properties combined with a potentially very low work function and high thermal stability.

1. Introduction

How is black diamond obtained?

Black diamond is obtained by a controlled periodic texturing of CVD transport capabilities.

Can Black Diamonds be irradiated with solar light?

It is worth considering the total charge generated within the black diamond if irradiated with solar light with respect to a possible energy conversion mechanism. Supposing that: all the photogenerated charge carriers can be transported from the generation zone to the electrodes by an internal field.

Why is diamond a good material for electronic devices?

Diamond is an attractive material for the development of electronic devices owing to its outstanding electronic properties such as high carrier mobility, high breakdown electric field and high carrier saturation velocity.

The mobility-lifetime  $\mu_e \tau_e$  product of the analyzed black diamond films is reported comparatively in Fig. 2 as a function of the absorbed accumulated fluence (the case for  $F_A = 0 \text{ kJ/cm}^2$  refers obviously to untreated diamond films), that is considered the proper common parameter for comparing the different samples. It is immediate to notice that the  $\mu_e \tau_e(F_A)$  ...

Black diamond is obtained by a controlled nanoscale periodic texturing of CVD diamond surface, able to drastically modify the interaction with solar radiation from optical transparency up to solar absorptance values even  $>90\%$ . Surface texturing, performed by the use of an ultra-short pulse laser, is demonstrated to induce

an intermediate band within the diamond bandgap supporting ...

The final p/i/n structure merges the technologies of surface texturing by fs-laser, boron-implantation for formation of buried p-type layer, and laser-induced graphitic microchannels, to form an innovative defect-engineered black diamond cathode for the conversion of concentrated solar radiation operating at high temperature. Ongoing ...

Fs laser irradiation of diamond has already allowed the tailoring of diamond optical properties [3, 22] and the development of black diamond films for solar energy conversion [16, 23] with enhanced optical absorptance in the UV-VIS-NIR range and drastically improved sub-bandgap responsivity. Exploiting surface graphitization, the response of fs laser processed ...

1 Introduction. In the coming era of "Carbon Peak and Carbon Neutrality," [1, 2] it is particularly important to develop new energy technologies with low cost, environmental friendliness, and industrial scale to replace the traditional fossil fuels, [2-6] which are widely considered to cause greenhouse effect and frequent extreme weathers. Solar energy is a kind ...

DOI: 10.1016/J.CARBON.2016.09.061 Corpus ID: 138862827; Graphite distributed electrodes for diamond-based photon-enhanced thermionic emission solar cells @article{Girolami2017GraphiteDE, title={Graphite distributed electrodes for diamond-based photon-enhanced thermionic emission solar cells}, author={Marco Girolami and Luigino ...

Spectrophotometric measurements in the 200-2000 nm wavelength range returned outstanding solar absorptance values for all the fabricated films (reaching the unprecedented value of 99.1% in the "2D-like" structure), launching double-nanotextured black diamond as a possible alternative to black silicon as absorbing layer for high-efficiency ...

[77] Calvani P, Bellucci A, Girolami M, Orlando S, Valentini V, Polini R and Trucchi D M 2016 Black diamond for solar energy conversion Carbon 105 401-7 Crossref Google Scholar [78] Girolami M, Bellucci A, Mastellone M, Orlando S, Valentini V, Montereali R M, Vincenti M A, Polini R and Trucchi D M 2017 Impact of laser wavelength on the ...

A continuing challenge for solar energy conversion is efficiency. The maximum efficiency for a silicon solar cell is 33%. Technological advances look towards other materials, such as perovskites, or new cell compositions, such as double-sided cells or tandem cells.

This clean energy solution will positively impact the City of Chicago and Illinois communities in the transition to a more sustainable future." Additionally, State Farm and PPG will purchase zero-emission, renewable energy from the Double Black Diamond solar project. Illinois-based State Farm will procure approximately 103,000 MWh of energy ...

Black Diamond Solar is a solar photovoltaic (PV) farm in pre-construction in Christian County, Illinois, United States. Log in; Navigation. Main page. Recent changes. ... Swift Current Energy [100%] Read more about Solar capacity ratings. Location Table 2: Phase-level location details for Black Diamond Solar. Location

Swift Current Energy, a Boston-based solar and wind project developer, has kicked off construction on the Double Black Diamond solar project in Illinois, an 800 MW(dc) utility solar project that is vying for the recognition of being ...

DOI: 10.1016/J.APSUSC.2016.02.107 Corpus ID: 137959098; Optimization of black diamond films for solar energy conversion @article{Bellucci2016OptimizationOB, title={Optimization of black diamond films for solar energy conversion}, author={Alessandro Bellucci and Paolo Calvani and Marco Girolami and Stefano Orlando and Riccardo Polini and Daniele Maria Trucchi}, ...

However, R8 and hexagonal diamond (Si-IV) have been considered as possible light absorbers for solar energy conversion. Biaxial tensile strain in excess of 4% leads to an indirect to direct band gap transition (from the Si-IV indirect gap of 0.95 eV into a direct gap of 0.7-0.9 eV (Ref. 9 )).

1. Introduction. In the field of solar energy concentrating systems, conversion modules based on Photon-Enhanced Thermionic Emission (PETE) [1], [2] have been proposed as a valid alternative to conventional solar cells. Basically, a PETE module consists of a semiconductor-based cathode, engineered for an optimal combination of thermionic and ...

BOSTON and HOUSTON, August 9, 2023 - Swift Current Energy (Swift Current) announced today that it has closed project financing for its 800 MWdc (593 MWac) Double Black Diamond Solar project. Once operational, Double Black Diamond Solar is expected to be second largest single phase solar project in the US, and the largest solar project in MISO, producing enough ...

Black diamond, namely a surface textured diamond film able to absorb efficiently the sunlight, is developed by the use of ultrashort pulse laser treatments. With the aim of fabricating a 2D periodic surface structure, a double-step texturing process ... Optimization of black diamond films for solar energy conversion.

Figure 1. Solar photons convert naturally into three forms of energy--electricity, chemical fuel, and heat--that link seamlessly with existing energy chains. Despite the enormous energy flux supplied by the Sun, the three conversion routes supply only a tiny fraction of our current and future energy needs.

Black diamond, namely a surface textured diamond film able to absorb efficiently the sunlight, is developed by the use of ultrashort pulse laser treatments. With the aim of fabricating a 2D periodic surface structure, a double-step texturing process is implemented and compared ...



# Black diamond for solar energy conversion

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