Research paper

Materials

Properties

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Cover story – continued

But lowering the price of solar-produced electricity remains an obstacle even in a place like the Mojave Desert of Nevada, where clear, expansive skies provide an optimal setting for harnessing the sun's abundant rays. At the same time, also in December 2007 in San Luis Valley Alamosa, CO in USA the Alamosa Photovoltaic Solar Plant with the total power above 8 MW was set to work.
Several European countries have built many large-scale photovoltaic power plants. Germany is the biggest solar energy producer in the world, albeit the biggest solar plants in the world are in Spain so far; however, they are often developed with participation of German capital. Spain is the second largest solar power European market. On 23rd March 2007 just in Spain, the largest at that time in the world, solar power installation in Beneixama (Alicante) was set to work, shown in the middle small photo on the cover. It has been built among olive trees on hillside pasture, which will remain productive farmland. It occupies a plot the size of seventy football fields and can supply all the energy needs of 12,000 households all year round. When fully operational, it will operate 100,000 solar panels. They will generate 20 MW of energy in total. The main benefit of the Beneixama plant is that it will reduce CO_2 emissions by 30,000 t each year. The total cost of the project is estimated to be around €150 million. Although currently the world's largest installation of its type anywhere in the world, record ten, as the investors have expected will be beaten soon, as larger solar power farms are opened at many locations. This has shortly become true. The world record was beaten already in January 2008, when the biggest currently solar power plant Parque Solar Hoya de Los Vincentes, Jumilla in Murcia, Spain was opened. This plant will reduce CO_2 emissions by 42,000t and SO_2 emission by 9.2 t each year.
In the meantime also other very big solar power plants were developed in many countries. On 28th March 2007 one of the world's largest solar energy plants and Portugal's first large photovoltaic installation, covering the hills of a valley dotted with olive groves, has opened in Serpa, small village in southern Portugal's poor agricultural Alentejo region one of Europe's sunniest spots, 200km southeast of Lisbon, started delivering electricity to about 8,000 households. The 11MW solar power plant uses 52,000 photovoltaic modules and cost around $75milion. The solar panels, which are raised around 2 metres off the ground (allowing sheep to graze on the grass below), cover an area of 60 hectares. In the last small photo sheep can be seen grazing in the solar power plant area. However, this photo was made in one of the solar power plants in Germany, and not in Spain. The plant in Serpa uses system that follows the sun's daily path across the sky to generate up to 35% more electricity than conventional fixed-mounted systems. The relatively small number of moving parts significantly reduces operating and maintenance costs, with a patented 'linked' design requiring only one drive motor per 200kW. A galvanized, corrosion-resistant steel frame brings high strength. A mechanical mounting system securely fastens the solar panels to the tracking system, which is designed to withstand extremely high winds in any position. A Data Acquisition System (DAS) provides daily system performance monitoring. The system requires significantly less land coverage than dual-axis solar tracking systems. An industrial controller backtracks to eliminate row-to-row solar panel shading, so increasing energy production throughout the year. The installation saves more than 30,000 t a year in greenhouse gas emissions. After eight months of construction and testing, the project began feeding Portugal's electricity grid in late January 2007.
On 2nd April 2007 Europe's first concentrated Solar Tower Complex was open recently near the sunny southern Spanish city of Seville. The 11 MW plant took four years to build and it uses 624 large movable mirrors called heliostats. Each of the mirrors has a surface measuring ca. 120 square metres that concentrates the Sun's rays to the top of a 115 metres high tower where a solar receiver and a steam turbine are located. The turbine drives a generator, producing electricity. Sevilla PV is the largest low concentration system solar plant in Europe (the only one from the described here in which the photovoltaic effect is not used). It is the first of a set of solar electric power generation plants to be constructed in the same manner that will total more than 300 MW by 2013. Power generation will be accomplished using a variety of technologies.
In September 2007 Planta Solar de Salamanca in Salamanca, Spain, was opened with power of 13.8 MW. Two next big solar power plants are planned to be opened in Spain this year: Solarpark Calaveron with power of 21 MW and Planta Solar La Magascona in Trujillo (Cáceres) with power of 20 MW.
South Korea is building one of the largest solar installations in the world. The plant, being built in Shinan, near the southwestern tip of South Korea, is scheduled to be completed by late 2008. It is to feature 109,000 rectangular solar modules that will cover a seaside plot the size of 80 football fields. The modules will tilt on a tracking system to generate up to 20 MW of electricity. With its emission of greenhouse gases increasing faster than in most developed countries, South Korea agreed to subsidize the solar plant, even though the plant's power is to be as much seven times as expensive as power from nuclear or coal.
The world's biggest 40 MW photovoltaic power plant will be located in the former military air base in the townships of Brandis and Bennewitz to the east of Leipzig, in the state of Saxony in eastern Germany. On February 2007 investor from Bolanden in the state of Rhineland-Palatinate, Germany, has received building approval for this solar power plant. The installation will be built on half of the location's 220 hectares and will be finished by the end of 2009. The area is about one kilometre wide and approximately two kilometres long. It takes more than about 200 football fields. The solar plant matches the annual demand of more than 10,000 households and will reduce CO_2 emissions by 25,000 t each year
Topics related to photovoltaics are mentioned relatively often in the Journal of Achievements in Materials and Manufacturing Engineering and also in this Issue.

Selected materialographical photo

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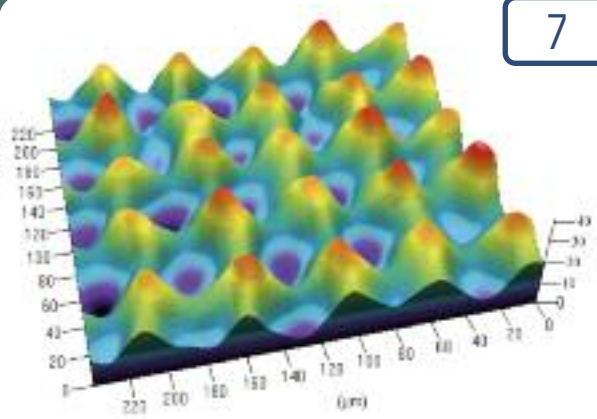

The research paper made by L.A. Dobrzański and A. Drygała on "Laser texturisation in technology of multicrystalline silicon solar cells" on a **page 7** describes technology of multicrystalline silicon solar cells with laser texturisation step. The texturing of polycrystalline silicon surface using Nd:YAG laser makes it possible to increase absorption of the incident solar radiation. Moreover, the additional technological operation consisting in etching in 20% KOH solution at temperature 80°C introduced into technology of the photovoltaic cells manufactured from laser textured wafers allows for significant improvement in their electrical performance compared to cells produced from the non-textured wafers after saw damage removal. Solar cells produced from laser-textured polycrystalline silicon wafers demonstrate worse electrical performance than cells manufactured from the non-textured wafers after saw damage removal as well as wafers textured by etching in alkaline solutions. Laser processing is a very promising technique for texturing multicrystaline silicon independent on grains crystallographic orientation compared to conventional texturing methods in technology of solar cells.

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The paper written by P. Gendarz, P. Chyra and R. Rząsiński on "Constructional similarity in process of ordered construction families creating" on a **page 53** informs that the main reason for starting research concerning theory of constructional similarity was needed to substitute a traditional method of creating ordered families by new algorithmic methods orientated on computer aiding. The main achievement presented in this paper is the development of the theory of constructional similarity orientated on computer aiding, and used in designing process of new technical features. Moreover, a method is highly susceptible to parameterisation. The method of construction similarity presented in the paper is a basis of selection of design features in the process of ordered construction families (series of types and module systems of constructions) creating. The presented method supports intensive development of the types of technical features and affects their competitiveness on the ready market. Described methods were being developed on practical examples of creating the module systems of hydraulic cylinders used in mining, slag cars used in metallurgy and gears series of types. Nowadays the gripping devices series of types are being made.

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