



For Immediate Release: 20 December 2011

TSS-04-2011

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TULiPPS First to Use Ultra-Thin, Single-Layer Solar Glass from Ducatt Tempered by LiSEC Method for Solar Modules

EINDHOVEN, The Netherlands – In another first for the solar photovoltaic (PV) module market, TULiPPS Solar B.V. is the first company to use special 2-mm/0.08 inch, single-layer toughened solar glass from Ducatt NV (Lommel, Belgium), produced via the patented tempering process developed by LiSEC Group (Hausmening, Austria). This ultra-thin ultra-clear glass provides frameless COSMOS™ solar modules from TULiPPS with increased break resistance, light transmittance, and energy-generating efficiency/unit area while also reducing module weight and overall costs (Watt-peak installed). Owing to TULiPPS' own patent-pending frameless module design, it is the first company able to take full advantage of the significant benefits of the special Ducatt glass produced on LiSEC tempering equipment that has the potential to significantly change how solar modules are built and their capacity to generate energy.

LiSEC is the market leader in high-quality glass-processing equipment, supplying systems to the world's largest flat-glass producers. The company has invested considerable research and development effort to perfect its new tempering process and to build automated processing systems that achieve new levels of performance in very-thin, very-light, and highly robust glass, which is ideally suited for solar applications like cold-bent parabolic reflectors or glass/glass PV modules. Eliminating traditional roller-based processes, LiSEC equipment can temper flat glass down to 0.9 mm/0.04 inch, achieving uniform microstructure, unrivaled density and bending strength (120 MPa/17,404 PSI and respectively equivalent to ~10,000 PSI surface tensile strength) plus superior optical properties. Since the glass surface is not touched during tempering, roller "waves" that can distort optics are eliminated and sheets can be coated on one or both sides prior to heat treatment without risk of damage. LiSEC's tempering process also reduces energy consumption 40% vs. competitive systems.

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TULiPPS is First to Use Ultra-Thin, Single-Layer Solar Glass in PV Modules

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Ducatt is one of the world's only dedicated solar-glass manufacturers and specializes in producing ultra-clear, ultra-thin, ultra-light low-iron solar glass that does not sacrifice strength. The company has just completed a €50-million (\$68-million USD) investment in a best-in-class dedicated solar-glass furnace/manufacturing line as well as glass processing and tempering lines – the latter exclusively outfitted with state-of-the-art equipment from LiSEC. The new tempering line has been optimized end-to-end for quality and speed to produce ultra-clear (95% transparency with minimal reflectivity), ultra-thin (down to 2 mm), and ultra-strong (fully tempered) rolled solar glass. This special glass helps reduce shipping costs and facilitates module installation. Plus, its exceptional clarity means that it can help improve any module's energy-generating efficiency by 4%.

This new thinner glass offers distinct benefits to manufacturers, installers, and owners of PV modules in terms of transparency/energy-generation, break resistance, and lower weight. However, as often happens when a breakthrough is made and technology makes a significant advancement, an industry's specification and certification systems are often inadequate to properly quantify and qualify the performance benefits gained with the new technology. Worse, measured or calculated values obtained from these specifications often contradict what the eye can clearly see with regard to how much better a technology performs during testing vs. older products. This is the case with very-thin tempered glass.

The first problem is that currently the term “fully tempered” glass – which is required for use in solar PV modules to ensure safety of workers during installation and maintenance – refers to the physical properties (strength) of single-layer ESG/safety glass, but it also refers to a “fracture” image. The new thinner glass (in cross-sections lower 2.7 mm/0.11 inch) behaves differently and produces a different fracture image than thicker “classic” tempered solar glass. By conventional measurement, it resembles only heat-strengthened glass; however, in physical testing, it behaves like fully tempered glass, and in fact provides far superior break resistance if properly supported in the testing apparatus. And that bring up the second challenge: the test setup itself.

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3-3-3-3

Since this new glass is more “bendable,” it must be allowed to move in order to absorb and dissipate energy during an impact event. Module designs where the new thinner glass is rigidly constrained on all four edges can prove problematic. The same is true when the glass is rigidly constrained in a test fixture (rather than being mounted onto a stable supporting device) during laboratory evaluation. One of the strengths of the new COSMOS module design from TULiPPS is that it is frameless and the glass, while supported via a tough energy-absorbing composites underbody, is allowed to move, dissipating energy wave patterns that would cause breakage in conventional rigid aluminum-framed module designs. Since most testing facilities have little experience analyzing this new thin glass, they may not realize they need to modify test fixtures to get a more realistic view of how the glass behaves and the design of modules in which the glass is likely to be installed.

Still another testing challenge is that the industry’s commonly used measurement device for determining the “strength” of flat glass is a Strainoptics laser GASP® non-destructive measurement system¹. This device actually measures residual surface stresses rather than strength itself. Because cooling conditions for 2-mm glass are different from that of 4-mm glass owing to different skin/core/skin relationships, the residual stress distribution between the two glass samples will vary considerably. The stress-level differentials between both types of glass are also quite dissimilar, and there is question as to whether this measurement system will have value when used to evaluate performance of the new thinner glass.

Another challenge is simply one of nomenclature. When U.S. flat-glass and module makers or certifiers discuss the strength of the glass, they are referring to surface compression only. In Europe, however, the term is used to mean bending strength, which is a measurement combining both surface compression and inner (core) tensile strength. In the case of thin glass tempered via the LiSEC method, the difference between what is measured/calculated can be significant: by the U.S. definition, strength of the glass is ~10,000 PSI, but by the European definition, the “corrected” value is 17,404 PSI as proven during bending tests. Hence the industry needs to tighten up what it is referring to and how that value is measured in order for parties in all geographies to be sure the same property is being discussed. There is no doubt that industry and certification organizations have work ahead of them to deal with the implications of this new technology.

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¹ [http://www.strainoptic.com/files/Laser%20GASP%20Quick-Start%20\(English\).pdf](http://www.strainoptic.com/files/Laser%20GASP%20Quick-Start%20(English).pdf)

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According to Paul Stassen, TULiPPS Solar inventor and managing director, “When I first saw this very-thin glass made by LiSEC tempering equipment, I was simply amazed by its flexibility and strength. At just 2-mm thick, it literally offers the same strength as conventional low-iron solar glass at 3.2 and 4.0 mm, yet it is half the thickness and far lighter. I quickly realized that it was the perfect complement to TULiPPS’ frameless COSMOS PV module design. You cannot take full advantage of thin solar glass if you use a rigid aluminum frame. Even more importantly, with this special glass we achieve a new standard in transparency – 95% vs. typical 91% seen with thicker, low-iron solar glass – so our modules not only weigh less, but they are also more energy efficient – the holy grail of the solar PV market. This means a faster return on investment for module owners. The combination of LiSEC’s special tempering process, which preserves strength even in very-thin glass, Ducatt’s exceptional glass clarity and transparency, and TULiPPS’ patent-pending module construction method means that the new COSMOS modules represent innovation to the power of three.”

Notes Roel Bollen, chief-executive officer, Ducatt NV, “We are very excited to be working with a visionary company like TULiPPS, because their unique module design is the best technology platform we have seen to showcase the many benefits of our singular solar glass. Literally and figuratively, the COSMOS module allows Ducatt to fulfill its mission to help our customers harvest the energy of the sun while saving on energy costs. We feel this product sets a new gold-standard in solar glass.”

Ing. Leopold Mader, managing director-Development & Technical Division, LiSEC continues, “We applaud management’s vision at both companies. Ducatt’s new tempering line is the world’s leading example of what our process and equipment can achieve. We are so proud that a new company has chosen to fill a new hall with a complete LiSEC machine path. Now our equipment will be used all together, the way it was meant to be, so the full benefits of the technology will really shine. Ducatt’s investment means its customers can be assured of the thinnest, strongest tempered solar glass possible. And by selecting Ducatt glass, TULiPPS has guaranteed that its modules will not only be very light and break resistant, but also more energy efficient, which will help solar PV achieve grid parity faster.”

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5-5-5-5

Johann Weixlberger, manager-Business Development at LiSEC adds, “We predicted the growth in demand for thin tempered solar glass for thin-film, glass/glass modules. However, we never anticipated a module design that would use a single layer of thin glass by itself with silicon cells. With the approach that TULiPPS has taken, they have literally opened up a new market for thin solar glass, and that makes us very happy.”

Stassen concludes, “The world is about to change. The cost of solar PV is declining rapidly with residential costs already comparable in price to electricity generated from fossil fuels in Italy, the Netherlands, and five U.S. states. It will not be too long before economies of scale will make solar PV energy cheaper than non-renewable sources. COSMOS module technology will change the game for solar PV because it offers the unbeatable combination lowest cost, highest output, longest service life, and lowest carbon footprint. Our systems will achieve the highest ROI because we will have the lowest installed cost base and the highest conversion efficiencies of any PV module technology. And our partnership with Ducatt is vital to help us achieve these goals.”

New patent-pending COSMOS module technology from TULiPPS Solar B.V. – available in standard 72- and larger 120-cell configurations – has carefully been designed to address deficiencies with conventional PV systems in order to bring greater value to all members of the solar PV supply chain – from the PV module manufacturers and module installation companies to building owners and investors. Developed in partnership with leading companies in the automotive composites, roofing, and PV industries, and with financial support from the Province of Noord-Brabant and assistance from the Brabantse Ontwikkelingsmaatschappij in the Netherlands, the modules reduce weight, production costs, installation time and maintenance, as well as increase revenues, and lower system costs (Watt-peak installed) for the next generation of solar PV modules. Key to the success of the system is the combination of tough but lightweight automotive-grade composites, a frameless support system with *plug-'n-play* functionality, a proven roof-anchor system that does not penetrate the roof membrane, and special thin 2-mm/0.08 inch, single-layer toughened solar glass from Ducatt NV that provides improved break resistance and industry’s highest light transparency and therefore offers greater energy conversion per unit area. COSMOS module technology can be used for roof- or ground-mounted solar arrays and building-integrated PV (BIPV) modules in all existing PV module factories.

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LiSEC is a global company setting new standards in manufacturing quality and technology with machines, software, and services to process and finish flat glass. The company has achieved unrivalled expertise in processing, handling, and thermally treating thin glass, which is lightweight and robust. Thin glass tempered with LiSEC furnaces achieves a consistent microstructure with unprecedented high density and surface tension. Under high pressure or when struck, properly supported safety glass will bend without breaking. Optical distortions, or roller waves, which occur in conventional horizontal tempering furnaces with roller transport, are a thing of the past. With 50 years' experience in the flat-glass industry, LiSEC offers a comprehensive range of components for processing series, functional, and solar glass, including buffer, loading and sorting systems, cutting tables, edge-processing machines, quality scanners, and tempering furnaces. With its own Competence Centre for thin-glass testing, LiSEC is the specialist for all thin-glass concerns.

Ducatt is a spinoff from Emgo, a market leader with more than 45 years' experience in glass development, manufacturing, and processing. As one of the world's only exclusively solar-glass manufacturers, Ducatt specializes in producing dedicated, ultra-clear, anti-reflective, ultra-thin, ultra-light and toughened low-iron solar glass that does not sacrifice strength. The company name refers to the Italian 'Ducato' coin, the official currency of the Republic of Venice in the 13th century. It was made of almost pure gold and became the general trade coin of Europe. This name not only conveys Ducatt's ambitions to be the international gold standard in thin solar glass, but it also is a metaphor of the company's mission to help its customers harvest energy from the golden sun and save costs. The company is headquartered just 20 kilometers/12 miles from one of Europe's best quarries for low-iron sand and a transport hub for Essers, Belgium's largest logistics service, is housed right at Ducatt's production facility. This, plus a closely monitored supply chain, helps the company produce glass according to Triple Green principles, maintaining an environmentally sound, locally manufactured, sustainable product that is shipped to customers via cost-effective and rapid transport. With tailor-made solutions for PV crystalline silicon and thin-film modules, flat-plate solar thermal collectors, CSP systems, and even greenhouses, Ducatt is positioned to support growing interest in solar energy.

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7-7-7-7

For More Information

TULiPPS Solar B.V. is a startup company with patent-pending technologies for the next generation of solar PV modules. It is one of three companies just nominated for the **2012 Dutch Solar Innovation Awards** in the *Industrial Development* category. See: <http://www.tulipps.com/>, or eMail: sales@tulipps.com or call: +31 (0) 40.7516.290, or mail: TULiPPS Solar B.V., High Tech Campus 9, 5656 AE Eindhoven, The Netherlands.

LiSEC Group is a world leader in complete manufacturing solutions for tempering and encapsulating flat glass. See: <http://lisec.com>, or eMail: info@lisec.com, or call: +43-7477-405-0, or mail: Bahnhofstrasse 34, AT 3363 Hausmening, Austria.

Ducatt NV specializes in production of low-iron solar glass – particularly ultra-clear, ultrathin, ultralight solar glass that does not sacrifice strength. See: <http://www.ducatt.com/>, or eMail: mail@ducatt.com, or call: +32 (0) 11 559 300, or mail: Industriezone 1050, Balendijk 161, B-3920 Lommel, Belgium.

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COSMOS product development is sponsored by the PROVINCIE NOORD-BRABANT.



TULiPPS has been nominated for the 2012 Dutch Solar Awards.



COSMOS™

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EINDHOVEN, THE NETHERLANDS – In another first for the solar photovoltaic (PV) module market, TULiPPS Solar B.V. is the first company to use special 2-mm/0.08 inch, single-layer toughened solar glass from Ducatt NV (Lommel, Belgium, <http://www.ducatt.com/>) produced via the patented tempering process developed by LiSEC Group (Hausmening, Austria, <http://lisec.com/en>). This ultra-thin ultra-clear glass provides TULiPPS' solar modules with increased break resistance, light transmittance, and energy-generating efficiency/unit area while also reducing module weight and overall cost (Watt-peak installed). Owing to TULiPPS' own patent-pending frameless module design, it is the first company able to take full advantage of the significant benefits of the special Ducatt glass produced on LiSEC tempering equipment that has the potential to significantly change how solar modules are built and their capacity to generate energy.

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EINDHOVEN, THE NETHERLANDS – TULiPPS Solar B.V. today announced that will be first company to use special 2-mm/0.08 inch, single-layer solar glass from Ducatt NV (Lommel, Belgium, <http://www.ducatt.com/>) produced via the patented tempering process developed by LiSEC Group (Hausmening, Austria, <http://lisec.com>). LiSEC's tempering systems produce lightweight, extremely flexible, and highly robust glass with uniform microstructure, and unrivaled density and surface tensile strength as well as superior optical properties, making it ideally suited for solar applications. Ducatt's own expertise is producing low-iron, heat-treated, rolled solar glass – particularly ultra-clear (up to 95% transparency with minimal reflectivity), ultra-thin (down to 2 mm), ultra-light solar glass that does not sacrifice strength (bending strength of 120 MPa/17,404 PSI, respectively equivalent to ~10,000 PSI surface tensile strength). This special glass resists breakage, helps reduce shipping costs, facilitates installation, and enables frameless modules like TULiPPS' COSMOS technology to be used. And with exceptional clarity, the glass helps improve energy-generating efficiency per unit area

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