Moscow, Russia

An investment/joint-venture project proposal

OFF **ON**

Electrochromic glazing for architecture & design

(Windows, partition walls, sunroofs, etc.)

A promising cutting-edge technology

A new-generation Russian patented electrochrome-glass technology has an enormous potential in architecture, interior and exterior design. It is unrivalled in optical quality, energy consumption, convenience, safety, reliability, durability, etc. Products are much cheaper than competition.

The Russian patent-holder is seeking WIN-WIN cooperation schemes with interested international companies.

A GLASS IS SAID TO BE ELECTROCHROMIC if it is capable of changing its color within seconds when a voltage is applied to it. This idea is not new, the first developments being made in Russia (USSR) many years ago. Russia continues to be at the forefront of electrochrome technologies. Now the next-generation technology, organic solid state technology has been developed and commercialized.

The wide spread of electrochromic "smart" glass in a wide variety of industries has been hampered by high costs, limited dimensions of products, and other imperfections.

We, Technoglass Engineering (TGE) of Russia, have dramatically improved the technology and reduced the costs of products. For technology and competition details see the Addendum.

Market potential

The market potential for light-control products is large, ever expanding, and wide-ranging.

A syndicated research study released in February 2001 by The Freedonia Group forecasted that the world market for flat glass will reach 42 billion square feet (approximately 3.9 billion square meters) by 2004. Its predictions as quoted in "2004 Survey of United States Architects on the Subject of Switchable Glazings," by G.M. Sottile, Research Frontiers Incorporated, Woodbury, NY (enclosed):

"Industry sales for switchable glazings are modest relative to their promising medium-term forecast. A 2002 study by the Freedonia Group (Cleveland, OH) reports that demand for smart glass in the United States is projected to grow at a compound annual rate of approximately 20.0% through 2006 to $445 million [4]. This rate of industry growth is nearly five times the 4.3% compound annual growth rate of total flat glass sales by U.S. producers from 1997 through 2002 [5]. Advanced flat glass, of which smart glass is a segment that also includes reflective glass, security glass and other niche glass products, is expected to account for 22% of the total amount of fabricated glass in the United States by 2006 [6]. To the extent that these rates of growth are duplicated in other regions of the world, a high probability exists that switchable glazings will be among the leading new classes of technology products in coming years."

Some information exists regarding the expected penetration of switchable ("smart") products in the United States. A nationwide study by the Townsend Research Group of US window manufacturers found that decision makers at these companies expect that 3.6% of all residential windows and **6.2% of all commercial windows will be "smart" by 2005.** Also, 13.5% of all new windows, doors and skylights installed or retrofitted in 2009 will be smart.

Electrochrome glazing holds such a high energy-saving potential that the US Government included the topic into its energy-saving plant till 2050.

Applications in architecture and design

TGE electrochromic glass can be used for windows, doors, roofs, partition walls, etc. The tintable electrochrome glass has a number of advantages.

Light control

On a sunny day you can darken windows with the result that sunshine does not blind you anymore, also does not interfere with your work on computers. Darkened can be entire windows or parts of them.

Privacy

You can see through a darkened window, whereas you are not seen. This produces an effect of privacy in offices and conference rooms.

UV protection

In any position TGE glass does not let through UV radiation, thus protecting furniture, paintings, wall paper, etc.

Temperature and energy control

In summer. Computer simulation has shown that electrochrome windows:

- Cut air conditioning costs by 49%
- Reduce peak loads in the power supply system by 16%
- Cut lighting costs by 51% as compared with tinted glass.

In winter. TGE windows do not let heat out, by reflecting it back to a room, thus reducing heat losses by a factor of 4.5 as compared with a usual insulating glass unit. Their energy consumption is not more than 0.3 W/m^2, which is 250 times lower than that of a normal incandescent lamp (around 75 W).

Comfort and productivity

TGE glass windows improve the productivity of workers due to thermal control and the feeling of cool and comfort they produce.

Safety

Many other electrochrome technologies require voltages from 50 to 110 V, which may cause safety problems. TGE glass uses only 2 V, which is much safer. This makes this technology even suitable for glazing bath rooms and swimming pools.

Images

You can incorporate into a TGE window any image, e.g., a logo or symbol, thus making your window unique. This image becomes visible in the ON position.

Strength

TGE glasses are very strong. They were tested for strength as follows: a 3-kg weight was dropped from a height of 3 m. The weight punched a hole in the glass but otherwise the glass remained intact, i.e., it did not fracture and produced no dangerous fragments. This makes TGE windows ideal for children rooms, sports halls, or penthouses. With a special-purpose film applied to it, a window becomes even bullet proof.

Noise protection

TGE windows provide higher noise protection as compared with usual glass.

Eavesdropping protection

The mechanical and electrical properties of TGE glass make a TGE window more protected against eavesdropping.

What we seek:

We are prepared to consider any WIN-WIN cooperation proposals, such as:

Licensing – Any issues pertaining to industries, geography and duration are to be considered. They influence the price.

Joint venture – Construction or upgrading of a manufacturing facility in the Asia-Pacific region.

Any other cooperation ideas.

About TGE – www.tge.ru

We are an innovation company in the field of organic electrochromic materials and technologies. We are domiciled in Moscow, Russia.

R&D

We started research at TGE in 1975. In actual fact, that was the continuation of the research that had been performed for decades by the "fathers" of international electrochrome technologies Dr. Gavrilov and Dr. Shelepin who joined TGE at that time.

The objective of the current R&D is to improve the various aspects of the electrochrome technology and the technology of the manufacturing of EC products. The areas of research are:

- Widening the color spectrum. At the moment at the laboratory experimental samples have been obtained of the following colors: gray (black), green, red. Other colors are experimented with.
- Production of the electrochromic film. In 2005 film prototypes were produced.
- Production of larger sizes
- Shortening the dimming times.

Production

In June 2003 we marketed the first product, an electrochrome window for construction and design. At the moment we supply our glasses to manufacturers of windows, office partition walls, etc.

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Addendum

TGE Electrochrome Glass Technology

Patents:

Russia: filing date 26.09.2002, application No. 2002125637, patent No. 2224275 as of 20.02.2004, expiry date 26.09.2022.

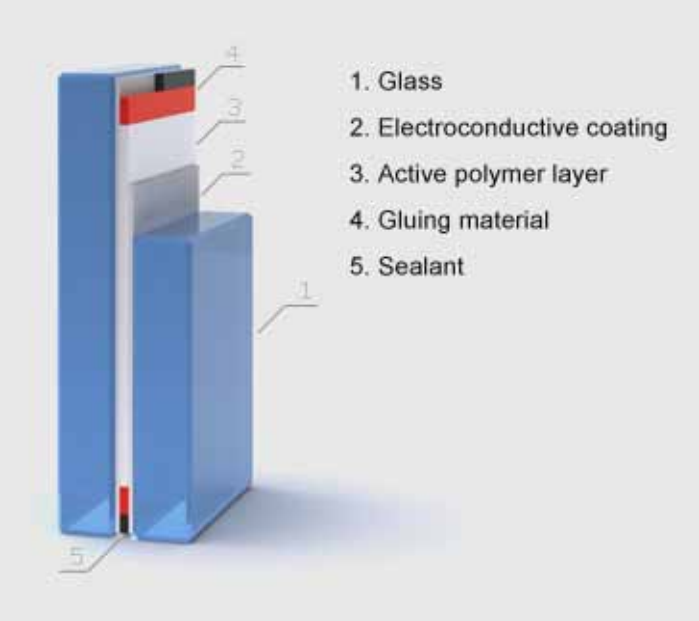
International: application No. PCT/RU2003/000414.

National phase:

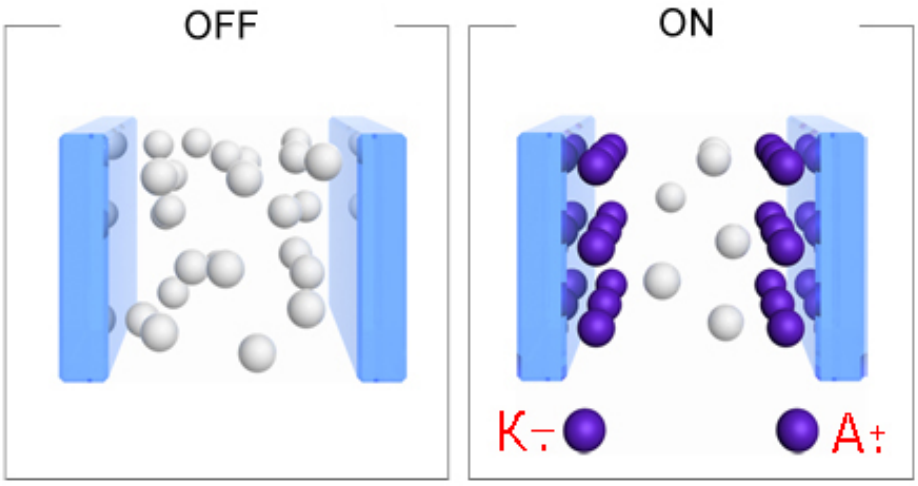
- USA, application No
- England, application No
- Germany, application No
- Australia, application No 2003271257
- China, application No

Products

A FINISHED HARD ELECTROCHROME PACKAGE is a triplex of two glasses with electroconductive coatings glued together by a 1-mm thick uniform jelly-like electrochrome layer. The electrochrome layer is chemically neutral and exudes no harmful substances.



In a normal (**OFF**) position the electrochrome layer is transparent (unlike some other technologies). When a 2-V voltage is applied (**ON**-position), within seconds the glass become tinted a preset shade of blue:



Advantages of TGE hard electrochrome technology

Large-sized surfaces of any shape. The nature of the TGE electrochrome layer enables large electrochrome surfaces (up to 2 x 1 m) of any shape to be fabricated. At the Grad Design Live exhibition in London this summer TGE exhibited the record-breaking 2.5-m long windows.

Stable color characteristics for life. Seven shades of blue. Forthcoming: green, claret, black (gray).

Wider working temperature range (–40 – +90°C) as compared with competition. This makes the technology ideal for exterior applications.

Ambient temperature control.

Wider light transmission range – 76–2% (at 1%, the glass is opaque). Competing technologies: 30–2%; 22–0.5%, i.e., “dark – very dark” or “light – very light”.

High UV stability allows the technology to be used for exterior glazing.

Low working voltage – 2 V, which is important for automotive uses. Competitive technologies: from 50 to 110 V.

In OFF position glass is transparent, i.e., during power supply failures the glass is not tinted, which is a problem with some competition.

High contrast at any viewing angle and any illumination level.

Longer life – 100,000 cycles.

Lower cost – Can be reduced with the economy of scale. Competition retail prices: from € 2,000 per 1 m^2.

Competitors

There are three international competitors of note:

Sage – www.sage-ec.com

A private US company that has been developing electrochrome glass products for building industries since 1989. Output is unknown. Shows interest in automotive markets; plans to launch the first commercial product late in 2005, in partnership with Velux (www.veluxusa.com).

Technology – Inorganic electrochrome composition, solid state.

Color – Blue.

Disadvantages:
Very complicated and expensive technology of the application of an electrochrome layer. The end product is expensive (declared price is ≈ $2,500 per m^2).

SGG (Saint-Gobain Glass) – www.privalite.com

Saint-Gobain Glass is one of the world's largest manufacturers of flat glass. The Flat Glass Division of Saint-Gobain, Saint-Goabin Vitrage, is well established and proactive in Europe and America and is now strengthening its presence in Asia. It is already industrially and commercially present in 35 countries, employing approximately 35,000 people globally. Its industrial capacity makes it the leading manufacturer of flat glass in Western Europe and a front runner worldwide.

Technology – Liquid Crystals

Color – no darkening, just light scattering, "frosted" dimming

Advantages:

- There is a possibility of the manufacture of films
- Fast response times
- Display screens can be produced.

Disadvantages:

- In OFF position glass is "frosted", so that when power is off one sees nothing through the glass.
- Inadequate thermal and light characteristics
- The lower extreme of the temperature spectrum is only -5°C
- High working voltage (24-120 V) and energy consumption (about 20 W/m^2)
- No smooth control
- Product shape limitations
- Limited viewing angles
- Price from € 1,800 per m^2

Research Frontiers Incorporated – www.smartglass.com

The company develops and licenses suspended particle device (SPD) technology used in Vary-Fast™ SPD-Smart™ light-control glass and plastic products. SPD technology, made possible by a flexible light-control film invented by Research Frontiers, allows the user to instantly and precisely control the shading of glass or plastic, either manually or automatically.

Technology – SPD (suspended particle device)

Color – shades of blue

Advantages:

- There is a possibility of the manufacture of films
- Fast response times
- Light transmission can be controlled

Disadvantages:

- In OFF position glass is "frosted", so that when power is off one sees nothing through the glass.
- Inadequate thermal and light characteristics
- High working voltage (110 V) and energy consumption
- No smooth control
- Product shape limitations
- Light scattering at large angles
- Price from € 1,950 per m^2

Conclusion

The TGE Electrochrome Glass technology is extremely competitive.

Enclosure

2004 Survey of United States Architects on the Subject of Switchable Glazings," by G.M. Sottile, Research Frontiers Incorporated, Woodbury, NY