

**2007 European Glass Manufacturing
Technology Innovation of the Year Award**
**Award Recipient: Degussa Novara Technology s.p.a.
(NTECH)**

2007

FROST & SULLIVAN

European Glass Manufacturing
Technology Innovation of the Year Award**AWARD DESCRIPTION**

Frost & Sullivan's Technology Innovation Award is bestowed upon a company (or individual) that has carried out new research, which has resulted in innovation(s) that have or are expected to bring significant contributions to the industry in terms of adoption, change, and competitive posture. This award recognizes the quality and depth of a company's research and development program as well as the vision and risk-taking that enabled it to undertake such an endeavor.

RESEARCH METHODOLOGY

To choose the award recipient, Frost & Sullivan's analyst team tracks innovation in key hi-tech markets. The selection process includes primary participant interviews and extensive primary and secondary research via the bottom-up approach. The analyst team shortlists candidates on the basis of a set of qualitative and quantitative measurements. The analysts also consider the pace of research and technology innovation, and the significance or potential relevance of the innovation to the overall industry. The ultimate award recipient is chosen after a thorough evaluation of this research.

MEASUREMENT CRITERIA

In addition to the methodology described above, there are specific criteria used to determine the final rankings. The recipient of this award has excelled based on one or more of the following criteria:

- Significance of the innovation(s) in the industry, and across industries (if applicable)
- Potential of the products of innovation(s) to become industry standard(s)
- Competitive advantage of innovation vis-à-vis other related innovations
- Impact (or potential impact) of innovation(s) on company or industry mind share and/or company bottom line
- Breadth of intellectual property related to the innovation(s), that is, patents, scientific publications, and papers in peer-reviewed journals.



The 2007 Frost & Sullivan European Technology Innovation of the Year Award in the field of glass manufacturing goes to Degussa Novara Technology s.p.a (NTECH), a wholly-owned subsidiary of Evonik Industries AG, Essen, for its development of a novel sol-gel process called SiVARA® for the manufacture of high-purity silica glass. The traditional process of manufacturing high-quality glass lenses involves processes such as cutting, grinding, and polishing. The SiVARA process represents a paradigm shift from traditional processes as it basically deals with working with the 'sol.'

Degussa Novara Technology s.p.a. was founded in 1992 as Gel Design and Engineering s.r.l. (GDE). It was established by a team of researchers and private investors with the objective of developing sol-gel technology for silica glass. It has been a fully owned subsidiary of Evonik Industries since 2003. Since its acquisition, Degussa Novara Technology has benefited by leveraging the R&D infrastructure and competencies of its parent Evonik. Evonik's chemicals business Area is also the largest supplier of synthetic silica - the key raw material for the sol-gel technique.

Sol-gel manufacturing process represents a low-cost alternative to currently used methods for producing silica glass. The SiVARA process is based on a special sol-gel process that facilitates the processing of fine powders such as AEROSIL®, as well as AERODISP® dispersions, into compact glass-mold bodies free of cracks. Aerosil, a fumed silica and Dynasylan, tetraethoxyortosilicate, also known as TEOS, are the basic raw materials of the SiVARA process. These raw materials form a colloidal suspension of silica particles known as sol inside the reactor. This suspension is then poured in the mold where it gels and forms a silica network. This is subject to a fluid exchange procedure before being moved into an autoclave for drying. Upon drying, an aerogel is obtained which is then withdrawn from the mold and sent into a furnace. Here, it is subjected to the final stages of chemical purification to obtain a silica product that demonstrates high purity levels, which result in very good optical transparency over a broad electromagnetic spectrum ranging from ultraviolet to infrared light.

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Previous attempts to manufacture silica glass using sol-gel routes failed because the silica glass produced was subject to breakage. Degussa Novara Technology has been able to overcome this obstacle and achieve very high geometric reproducibility of its glass objects. It has accomplished this through by leveraging the principle of molding and gelling of liquids at room temperature. In fact, by using the SiVARA technology it is possible to predict the final dimensions of an object with a precision of 1 over 1,000. This high accuracy meets the requirements of many high-end applications. Such level of precision is reachable by conventional techniques only after expensive after-treatments.

Vis-à-vis conventional techniques, the objects produced via SiVARA do not need after-treatments such as cutting, polishing, or grinding. Further, current techniques for the manufacturing of quartz objects are based on the melting of the raw materials and the pouring of the melt (> 1700 degrees C) in molds. Degussa Novara Technology's know-how facilitates molding to be conducted at room temperature. This provides a significant amount of freedom in terms of shape-design and material used for molds. As an example, low cost plastics can be the raw materials for molds for the manufacture of very sophisticated quartz objects; the same objects are affordable by conventional techniques only with very expensive equipment and treatment.

As Degussa Novara Technology's process is based on formulating a water-based dispersion that can be poured into a mold at a later stage and then densified in an oven, the investment is just a fraction of what would be required for quartz produced via conventional techniques. Moreover, the SiVARA process can work by using pre-existing or commonly available equipment. This feature also minimizes upfront/fixed cost. Since the procedure involved is quite simple, the operational costs involved are also quite low.

Other key benefits provided by the SiVARA technology include the production of a silica glass, which does not foam or produce bubbles when the material is subject to temperatures in excess of more than 1700 degrees C. The process also enables modification of the sol composition to produce glasses doped in a homogeneous manner for high tech applications. Although in the past, many multinational companies have allotted significant resources to research the viability of quartz shaping via using sol-gel techniques, NTECH is the only company that has been able to identify a viable and affordable way to take this technique from the proof-of-concept stage to the stage of technological demonstration.

Degussa Novara Technology is an innovation-focused company, and is based upon a business model that leverages nonexclusive licensing of its sol-gel know-how for the manufacture of quartz. The company's technological know-how allows its licensees to produce high quality quartz for various applications in optics (for example, lenses), optoelectronics (micro-lenses arrays), crystal fibers (mainly claddings), and semiconductors. The German company SGIL (Silicaglas Ilmenau), a spin-off of QSIL (Quarzschnmelze Ilmenau), is one of the first licensees of this technology. In the future, SGIL plans to base its production on the SiVARA process.

NTECH is a truly innovative company, and has been recognized as such. In 2005, NTECH was elected as one of the six finalists for the prestigious 2004 Descartes Prize in Europe, for best European Research Projects. In 2006, the firm won Evonik's 2005 worldwide Innovation Award for the best Innovation in the category of new applications for existing products (for Aerosil, a nanoscale, pyrogenic SiO₂ powder).

In summary, Frost & Sullivan applauds Degussa Novara Technology's for its development of the novel SiVARA process. The company has an innovative process and also

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serves as a comprehensive source from where customers can obtain raw materials, processing expertise, and process technology. The Technology Innovation Award recognizes this company's efforts to bring the sol-gel process to technological excellence and maturity and to developing the competencies required to manufacture glass bodies with complex shapes and textures.

About Best Practices

Frost & Sullivan Best Practices Awards recognize companies in a variety of regional and global markets for demonstrating outstanding achievement and superior performance in areas such as leadership, technological innovation, customer service, and strategic product development. Industry analysts compare market participants and measure performance through in-depth interviews, analysis, and extensive secondary research in order to identify best practices in the industry.

About Frost & Sullivan

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