

**IMMEDIATE RELEASE**

**220-300°C low-melting glass for hermetic sealing**  
*- Gold-tin solder level temperatures achieved -*

**Tokyo, November 26, 2012** - Hitachi, Ltd. (TSE:6501, "Hitachi") and Hitachi Chemical Co., Ltd. (TSE: 4217, "Hitachi Chemical") today announced the successful joint development of a 220-300°C low-melting temperature glass ("low-melting glass"). This glass was developed as a low temperature sealant which does not contain regulated materials<sup>(1)</sup> such as lead which presents a high environmental load or easily vaporized halogens such as fluorine or iodine.

The glass developed will form part of the line-up of Hitachi Chemicals' environmentally-compatible low-melting vanadate glass series, "*Vaneetect*,"<sup>(2)</sup> achieving even lower temperature applications. It is relatively inexpensive compared to gold-tin solder, a conventional low-temperature sealant, and provides better sealing properties than adhesive resins against air and moisture. Further, as the low-melting glass developed can be used with metals, ceramics and resins, as well as melted with a variety of heat sources such as hot plates, infra-red lamps, lasers, etc., it also opens up new possibilities for device structure and process technology. Sample shipments from Hitachi Chemical are available from today.

In December 2009, Hitachi and Hitachi Chemical successfully developed the environmentally-compatible low-melting vanadate glass "*Vaneetect*" with a sealing temperature of 350-400°C, as an alternative sealant to the toxic low-melting point glass containing lead and fluorine, or the relatively expensive gold-tin solder. In February 2012, Hitachi Chemical began mass production of *Vaneetect*, and it is now being applied in electronic devices, such as in crystal oscillators<sup>(3)</sup> and MEMS devices<sup>(4)</sup>. Gold-tin solder which can vacuum seal at around 300°C continues to be used, however, in high quality electronic devices. Further, to improve the reliability of electronic devices which currently use adhesive resins, there is a growing demand in recent years for improved air/moisture resistance. To address this need, Hitachi and Hitachi Chemical began development of an even lower temperature melting glass, and having discovered technology to control the glass structure, have succeeded in lowering the sealing temperature from 350-400°C to 220-300°C, and further improving resistance to water and vapor. Features of technology developed are as described below.

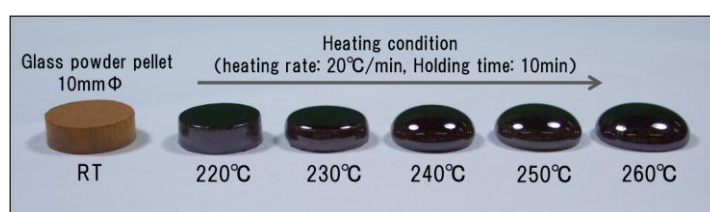
### (1) Lower melting temperature technology

With the previous low-melting glass technology, a low melting temperature as well as high hermetic sealing, and resistance to water/vapor was achieved by doping the glass-network structure with cations<sup>(5)</sup> which form weak bonds with oxygen ions and/or have a large ionic radius<sup>(6)</sup>. Based on this technology, a technique was developed to control the glass-network structure to allow the stable introduction of silver ions with the effect of significantly reducing the melting temperature to 220-300°C. By adjusting the amount of silver ion introduced into the glass structure, it is also possible to control the sealing temperature. Further, by reducing cations which easily bond with water molecules, superior water/vapor resistance was also achieved.

### (2) Features of the glass developed

- (a) Environmental impact can be minimized as the glass does not contain lead or halogens.
- (b) Due to a glass structure composed of only oxides, it can be heated and used as a seal in atmosphere, vacuum or in nitrogen gas.
- (c) The glass may be heated with various heat sources such as hot plates, infra-red lamps, various lasers, etc. Further, thermal degradation in temperature-sensitive organic devices or electronic devices using resin substrates can be prevented using a laser source to only heat the low-melting glass portion.

Given the above features, the glass developed is a potential alternative to gold-tin solders and adhesive resins, and as a low temperature air-tight sealant, to contribute to the realization of device structures which hitherto did not exist or new process technologies. The Hitachi Group will continue to actively pursue the development and practical application of new technologies to reduce environmental load.



Softening flowability characteristics of the glass developed

- (1) Regulated materials: Materials regulated by RoHS, REACH, etc.
- (2) Vaneetect is a registered trademark of Hitachi Powdered Metals Co., Ltd. in Japan.
- (3) Crystal oscillator: A passive device which uses the piezoelectric effect of a crystal to produce highly precise frequency oscillation.
- (4) MEMS: Micro Electro Mechanical Systems
- (5) Cation: An ion with a positive charge
- (6) Ionic radius: The radius of an ion (an atom with a charge) when viewed as a sphere

### **About Hitachi, Ltd.**

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 320,000 employees worldwide. Fiscal 2011 (ended March 31, 2012) consolidated revenues totalled 9,665 billion yen (\$117.8 billion). Hitachi is focusing more than ever on the Social Innovation Business, which includes information and telecommunication systems, power systems, industrial, transportation and urban development systems, as well as the sophisticated materials and key devices that support them. For more information on Hitachi, please visit the company's website at <http://www.hitachi.com>.

### **About Hitachi Chemical Co., Ltd.**

Hitachi Chemical Co., Ltd. (TSE: 4217), headquartered in Tokyo, Japan, is chemical manufacturing company with 16,713 employees, a sales volume of 473.1 billion yen (fiscal 2011, consolidated), with many products holding top market share. Its products are aimed at a wide range of materials and parts, including functional materials and advanced components/systems segments. The company is also focusing its efforts on “telecommunication & displays”, “environment & energy”, “life sciences”, and “automobiles & transportation infrastructure” as four key business fields.

For more information on Hitachi Chemical Co., Ltd., please visit the company's website at <http://www.hitachi-chem.co.jp/english/>

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Information contained in this news release is current as of the date of the press announcement, but may be subject to change without prior notice.

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