

**For immediate release**

**Highly-reliable low-k material technology for LSIs beyond the 65nm generation  
- Clarification of the degradation mechanism and a hundred-fold extension in lifetime -**

Tokyo, December 13, 2004 --- Hitachi, Ltd. (NYSE:HIT / TSE: 6501) and Hitachi Chemical Co., Ltd. (TSE:4271) announced today that they have developed a new technology which drastically improves the reliability of low-dielectric-constant (low-k) materials which will be indispensable for next-generation large-scale integrated (LSI) devices. The electrical degradation mechanism for low-k materials was clarified, and technology to prevent the degradation was applied at a molecular level resulting in a significant increase in lifetime. This technology is expected to contribute to the simultaneous achievement of substantial improvements in performance and reliability in next generation LSIs.

The integration density of LSI devices has continued to increase in response to needs for higher performance. This increase in density itself however has recently become a source of performance limitation, as signal delays are caused by increased line-to-line capacitance<sup>(\*1)</sup> between high-density metal wires. To reduce this capacitance, the dielectric constant<sup>(\*2)</sup> of the insulating material needs to be reduced. Simply decreasing the dielectric constant, however, causes deterioration in mechanical strength and long-term reliability -- a significant drawback for practical application of low-k materials. Although Hitachi Chemical has been leading development in low-k materials with high mechanical strength, long-term reliability was also considered as another key issue which needed to be resolved for future low-k materials.

In response to this challenge, Hitachi and Hitachi Chemical jointly investigated and clarified for the first-time, the degradation mechanism affecting long-term reliability, and developed a new long-lifetime highly-reliable low-k material. Important features of the technology are as below:

(1) Clarification of the degradation mechanism:

Chemical analysis was performed to investigate the structure of low-k materials degraded by electrical stress. The analysis revealed for the first time that the organic components of low-k materials are gradually deteriorated by electron energy. The deteriorated organic components were found to be replaced with water molecules leading to an increase in the dielectric constant of the low-k materials.

(2) Molecular-level degradation control:

Technology to control the organic components in low-k materials was developed. The reaction paths, temperature, speed, composition <sup>more</sup> and molecular weight were controlled during the synthesis process, and a durable molecular structure was designed. As a result, material lifetime was substantially increased from the current 10 years to 1,000 years.

The technology developed will be applied to Hitachi Chemical "HSG series", spin-on type low-k materials, for the 65-nm generation and beyond. These materials will support ongoing improvements in LSI performance to the 45nm generation..

These results will be presented at the 2004 IEEE International Electron Devices Meeting, held in San Francisco, California, U.S.A., from 13<sup>th</sup> - 15<sup>th</sup> December 2004.

Technical Terms:

- (\*1) Line-to-line capacitance: The electrical capacitance which is generated between neighboring metal wires. The larger the capacitance, the greater the signal delay traveling along the metal wires.
- (\*2) Dielectric constant: An index indicating the electrical characteristics of an insulating material. The lower the dielectric constant of the insulating material, the lower the line-to-line capacitance.

**About Hitachi, Ltd.**

Hitachi, Ltd. (TSE: 6501/NYSE:HIT), headquartered in Tokyo, Japan, is a leading global electronics company, with approximately 326,000 employees worldwide. Fiscal 2003 (ended March 31, 2004) consolidated sales totaled 8,632.4 billion yen (\$81.4 billion). The company offers a wide range of systems, products and services in market sectors, including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's Web site at <http://www.hitachi.com>.

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

Hitachi Chemical Co., Ltd. (TSE: 4217) headquartered in Tokyo, Japan, is an innovating global chemical company, with approximately 17,000 employees consolidated, fiscal 2003 (ended March 31, 2004) consolidated sales totaled 521.4 billion yen (\$4.9 billion). The Company offers diverse range of products, including Electronics-Related Products, Chemical-Related Products, and Housing Equipment and Environmental Facilities. For more information, please visit the Company's web site at <http://www.hitachi-chem.co.jp/english/>.

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