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**Joint Development of Material Recycling Technology
for Reuse of Developer in LCD Production
--- Construction of a Closed System for Zero Waste ---**

**Tokuyama Corporation
Sharp Corporation**

Tokuyama Corporation (Head Office: Shunan City, Yamaguchi; President: Shigeaki Nakahara; "Tokuyama") and Sharp Corporation (Head Office: Osaka City; President: Katsuhiko Machida; "Sharp") have jointly developed a material recycling technology to regenerate developer used in LCD production. A dedicated recycling device for collecting and condensing the developer used in the plant will be installed at the Sharp Mie Plant (Taki-gun, Mie Prefecture). The collected used developer will be regenerated by a special facility of Tokuyama and reused by Sharp Mie Plant.

Scheduled to begin operation in April 2005, the system will establish a closed developer system for the LCD plant.

Developer used in the photolithography process* for LCD panel production is prepared by diluting a concentrated solution. Since the amount of waste developer exceeds the amount of concentrated solution consumed, waste developer must be collected and condensed for reuse. However, because the used developer contains dissolved resist, a large amount of foam is produced during the collection and condensation of used developer. An antifoaming agent is usually used to suppress foaming, but this adds large amounts of impurities, making recycling of used developer extremely difficult.

Tokuyama and Sharp combined their advanced environmental technologies to successfully develop a material recycling technology for processing used developer generated during LCD production. Sharp successfully prevented foaming without using antifoaming agents by developing new recycling equipment featuring an innovative condensation tank design, which enables recovery of high-purity, high-density used

developer. On the other hand, Tokuyama will regenerate used developer delivered from Sharp at its dedicated recovery facility and supply a developer of quality equivalent to that of brand-new developer to the Sharp Mie Plant. This establishes a closed system for developer at the LCD plant.

As efforts proceed in the field of production to reduce resource consumption as part of global environment conservation efforts, much effort continues to be devoted to developing material recycling technologies for recovering and reusing waste materials. As a leading developer manufacturer, Tokuyama plans to promote material recycling technologies to large commercial-scale users of developer. Sharp will examine installing the above-mentioned system in other production bases while aggressively promoting the development of other material recycling technologies.

* **Photolithography process** --- Process used to form a thin-film layer of a specified shape on a glass substrate to create TFT (thin-film transistors) for an LCD panel. In this process, a certain pattern is formed through a series of process stages, including coating of photoresist, exposure, development (using developer), etching, and photoresist removal.

[Reference]

Tokuyama has engaged in business activities with special focus on environmental conservation. Using advanced production technologies accumulated in its activities as a developer manufacturer, Tokuyama began to develop material recycling technology for developers in 2000.

The company has established a pilot plant for developer generation in the Tokuyama Factory (Shunan City, Yamaguchi), and promotes external valuations. The plant has produced favorable results by producing a recycled material with high performance suitable not only for LCD production, but for the resists used in semiconductor gamma-ray and excimer laser applications.

Conventional environmental measures for developers have generally focused on reducing consumption. Since developer material recycling has been regarded as very difficult in

terms of technology and costs, such technologies have not previously been industrialized or commercialized.

Tokuyama manufactures developer at the Tokuyama Factory and at Hantok Chemicals Co., Ltd. (Head Office: Seoul, South Korea), a joint venture established with SAMSUNG Fine Chemicals Co., Ltd. The Tokuyama Group is the world's largest developer manufacturer.