

# Creating added value through dedication and passion

We have earmarked our functional film and sheet operations as priority businesses under the Mitsui Chemicals Mid-Term Business Plan, and in 2010, we combined those businesses of Mitsui Chemicals and our subsidiaries Mitsui Chemicals Tohcello and Mitsui Chemicals Fabro to integrate regarding Mitsui Chemicals Tohcello as a core.

In addition to taking over responsibility for high functional film products such as SOLAR EVA™ encapsulant sheets for solar cells and ICROST™ TAPE protective film for integrated circuits, Mitsui Chemicals Tohcello will also harness groupwide technical development capabilities in order to expand our operations in this sector.

The following article takes a look at our copper alloy coated hygienic films and sheets, part of the Mitsui Chemicals Group's range of functional film and sheet products.



## The challenge of creating copper alloy films and sheets with antibacterial properties

Here at Mitsui Chemicals, we have a truly wide range of film and sheet manufacturing technologies at our disposal. This gives us great flexibility in terms of creating applied products.

With that in mind, we knew that if we focused on the well-established antibacterial properties of materials such as silver and copper and were able to develop an integrated copper and resin film, we would be able to produce a wide range of applied products for use in medical and hygiene-related fields. In our determination to achieve that goal, we began to conduct research into copper alloy coated hygienic films and sheets.



**Akinao Hashimoto**  
Senior Researcher, Performance Film • Sheet Development Project (Leader, Team 1)  
New Materials Development Center

Research got underway in 2006. "We were trying to create an integrated copper and resin film that would have antibacterial and

anticorrosive properties, so that it wouldn't produce blue-green rust like copper," explains Koji Hirota from the New Materials Development Center. "We were also trying to make it as inexpensive and flexible as possible. Those were our three research objectives."

The team knew it wouldn't be easy, but the development process nonetheless proved more difficult than expected. "If we increased the copper content in order to improve the antibacterial properties, materials became susceptible to rust. Lowering the copper content meanwhile prevented us from achieving the required level of antibacterial performance. We knew that using an alloy would prevent corrosion, but we couldn't work out how to put that idea into practice. We seemed to be constantly coming up against brick walls." (Hirota)

## A burning passion that got everyone involved in practical experiments

Just as they were starting to lose hope however, one of the developers had a flash of inspiration whilst reading a book about the history of copper. According to Hirota, the team spent the next two weeks working flat out, barely even pausing to sleep, until they managed to

come up with an effective methodology. "It was based on a technology called vapor deposition, which involves turning metal into gas and depositing it in thin layers inside the device itself."

Using an alloy made it possible to prolong the material's antibacterial performance and prevent rust. The fact that the technology was an extension of vapor deposition technology meanwhile kept manufacturing costs to a minimum and meant that it could be used for various different applications. The team had achieved its three research objectives in spectacular fashion, in the form of a film that was just 10-100 nanometers\* thick.

The next question was whether the antibacterial properties of these newly developed films and sheets would actually be effective. The team tried affixing films to the back of interview sheets at a university hospital and running comparisons against untreated sheets. One researcher tried using the film as a pillowcase, based on its odor eliminating properties. Hirota got his wife to use some film as an insole after she complained that her feet tended to get too hot when wearing stockings. Hirota himself tried running laps around the



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Copper alloy thin films are thin in a range from 10 to 100 nanometers.



Products have a wide range of uses, including flexible ducts, plastic folders, masks and laundry bags.

development center and then putting his sweaty t-shirt in a bag made from the same sheeting... Everyone got involved in this series of simple experiments, even researchers and their families.

One experiment in particular involved affixing antibacterial films onto folders used for interview sheets. The results (see chart below) indicated a high level of antibacterial performance. "We are planning to take this to market at the start of fiscal 2012, including applied products," explains development project

team leader Akinao Hashimoto. "We're thinking about giving out samples to people running the marathon around the Imperial Palace and getting them to see how effective they are." Clearly, there are already new ideas in the pipeline.

Hashimoto and Hirota have named the materials in question "CopperStopper™" copper alloy coated hygienic films and sheets." The inspiration came from the English word "copper" and the image of bacteria being stopped by a police officer ("cop").

Most research and development is fairly unglamorous, consisting of a process of trial and error. When simple activities such as these produce concrete results however, there is a real sense of joy that you only get on the frontline of research and development.

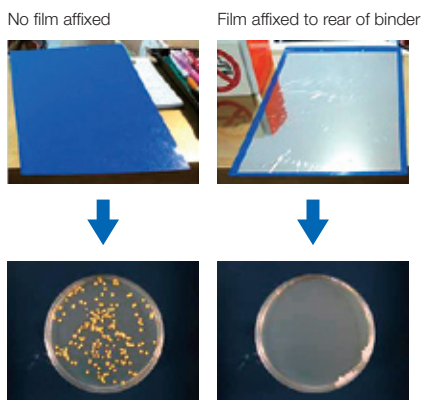
\* Nanometer: One billionth of a meter

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### Test results for interview sheet binders

Evaluated by Dr. Takeshi Sasahara, Kitasato University School of Medicine



Results for general bacteria after five months in use

### Comment

In addition to ensuring medical safety at all times, healthcare facilities also place top priority on combating hospital-acquired infections. At Kitasato University Hospital, we are currently trialing measures to improve hygiene by harnessing the potential antiseptic properties of copper and copper alloys. Trials have clearly shown a reduction in bacterial counts on surfaces such as door handles and wash stands that have been treated with copper. Just as we were thinking that it would be impossible to apply the same principles to items such as bedding and plastic folders, however, we came across a research team from Mitsui Chemicals, which is known for its outstanding polymeric and petrochemical manufacturing technology. They gave us their full support and came up with the idea for CopperStopper™, a unique corrosion-resistant copper alloy film with antibacterial properties. I have high hopes for the development of products in other everyday fields in the future, as well as healthcare.



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