

Head Office/Plant: 2804 Terao, Chichibu, Saitama, Japan 368-0056

Website: <http://www.ulcoat.co.jp/>

Main businesses: Hard mask blanks for semiconductors, large mask blanks for FPDs, glass MEMS, etc.

Subsidiaries: FINE SURFACE TECHNOLOGY CO., LTD. (Chichibu, Saitama), ULCOAT TAIWAN, Inc. (Taiwan), ULVAC Coating Technology (HEFEI) Co., Ltd. (China)



ULVAC COATING CORPORATION
FINE SURFACE TECHNOLOGY CO., LTD.



ULCOAT TAIWAN, Inc.



ULVAC Coating Technology (HEFEI) Co., Ltd.
(Architectural illustration)

World's First Hard Mask Blanks, Contributing to Semiconductor and Electronics Industries Worldwide

Mask blanks are essential materials to manufacture semiconductor integrated circuits (ICs). Without mask blanks, it would not be possible to enhance the functions of information devices such as computers, smartphones, automobiles, home appliances, and medical equipment. ULVAC developed mask blanks and commercialized them utilizing its vacuum thin-film technology for the first time in the world. ULVAC COATING CORPORATION has taken over the business and has been supplying mask blanks to users all over the world.

Materials development using ULVAC's own vacuum equipment at the origin of mask blanks

It was the latter half of the 1960s. ULVAC was developing materials by utilizing vacuum equipment it had fabricated internally. Chikara Hayashi, who was Vice President at that time, encouraged these efforts and provided instruction in support of them.

One material created was a hybrid thin

film made of chromium cermet (a type of chromium oxide compound metallic material), which was being applied to sunglasses to block direct sunlight. While the engineers were wondering in what other applications the material's characteristics could be utilized, it was left forgotten in the corner of an exhibit room, without ever having reached the commercialization stage.

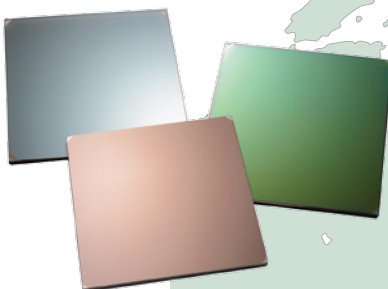
Then one day, a chance occurrence changed the course of events. A manager from a major electric appliance manufac-

turer happened to notice the sunglasses and said, "Since this chromium film blocks UV light, it might be usable in masks for making ICs." This comment piqued the curiosity of the engineers involved.

Right away, our company's engineers began to investigate the status of the masks being used for ICs. They found that an emulsion method based on photographic plates was being utilized to manufacture them.

■ Through its products, the ULVAC COATING Business Unit is contributing to cutting-edge fields worldwide.

● Mask blanks for semiconductors



● Glass MEMS



● Large mask blanks for flat panel displays



● Head Office and factory
Chichibu city, Saitama, Japan

● Hefei, China

● ULCOAT TAIWAN Inc. (Tainan city)



ULVAC COATING NOW ● Current Status and Outlook

Supporting Customers with a High-quality,
Global-scale with Stable Supply System.



ULVAC COATING CORPORATION
Yoshinori Kida, President and CEO

This year marks the 40th anniversary of our company, which was established on the same day as ULVAC TECHNO, Ltd., another company within the ULVAC group. Both companies were split off from the parent company, ULVAC. Since its establishment, our company had been operating with the goal of manufacturing mask blanks for semiconductor ICs. In 2000, we also began manufacturing mask blanks for FPDs. Our product currently commands a market share as high as 50% in that sector.

With the recent emergence of the

next-generation advanced information-oriented society, represented by such things as IoT, AI, and 5G, mask blanks for semiconductors and FPDs are becoming increasingly important.

Our company is committed to supporting customers with a high-quality, global-scale, stable supply structure. We will accomplish this by working with ULCOAT TAIWAN, Inc., established in Taiwan in 2002, and ULVAC Coating Technology (HEFEI) Co., Ltd., established in China in May 2018 with production planned to start in spring 2020.

Together, we will manage the entire series of processes critical to mask blank manufacturing, from polishing, cleaning, and film deposition to resist coating.

In mask blank manufacturing, increases in FPD resolution and levels of integration in semiconductor ICs are driving us to develop products that will meet anticipated market needs. Against this backdrop, our company is strengthening its collaboration with its parent company ULVAC, which makes vacuum equipment, in order to become a comprehensive mask blank manufacturer.

Development of world's first mask blanks and rollout to the global market

Advances in semiconductor ICs would not have been possible without the miniaturization of circuit patterns using photolithography processes. Photomask technology plays a central role in photolithography. And mask blanks are the basis for photomasks. As the name implies, mask blanks are blanks before circuit patterns have been created. They are currently used not only in semiconductor ICs, but also in flat panel displays (FPDs).

Mask blanks can be classified into two types according to the material used: hard masks and emulsion masks. In the late 1960s, hard masks had not yet been commercialized, and emulsion masks were the mainstream. Emulsion masks were made by coating a glass substrate with silver halide emulsion, used in photographic plates. The problem with emulsion masks was that since their coating surfaces were not transparent, they were not suitable for aligning multiple layers. As devices were becoming more highly integrated, users were demanding mask blanks that could be more accurately aligned.

The conclusion that ULVAC reached was as follows: "Since the light source used in the IC manufacturing process is UV light, visible light will not cause any problems no matter how much of it is allowed to pass

through the mask blanks. In other words, if films can be created that allow visible light to pass but not UV light, they can be aligned by the operator while the masks are being checked visually. By using the chromium film we recently developed, we can create mask blanks that sufficiently compensate for the shortcomings of the emulsion blanks."

In 1970, we successfully developed hard mask blanks based on chromium film. These were initially named "ST masks" and represented an unprecedented, spectacular achievement. ST stood for "see-through," indicating the characteristic of chromium film that blocked UV light, but allowed visible light to pass.

ULVAC SI Division split off to form independent ULVAC COATING CORPORATION

In 1971, ULVAC established its SI Department to focus on manufacture and sales of ST masks. The following year, the department was upgraded to the SI Division. Incidentally, SI here stood for Surface Instruments. It was given that name with the intention of utilizing vacuum equipment to create a variety of thin films and make a profitable business from them.

ST masks (hard mask blanks) became so popular that our company was receiving requests for quotes from Japanese semicon-

ductor manufacturers as well as from the U.S., which was considered the home of the semiconductor industry.

Around that time, ULVAC's internal newsletter "Vacuum Times" included the following write-up:

"It has been a year and a half since the SI Division began manufacturing and selling the world's only chromium oxide mask, and the product has become popular not only in Japan but also all over the world. Requests for quotes are beginning to come in from the U.S., the home of the electronics industry, and there are great expectations for purchasing agreements to be signed in the future."

ULVAC's mask business began to grow almost too quickly, aided by the rapid market expansion of the electronics industry occurring at that time, which centered around semiconductor devices.

In early April of 1978, the proposal to make the SI Division independent was approved. A decision was made to place the new company's head office at its current location (2804 Terao, Chichibu). That October, the name "ULVAC COATING CORPORATION" was selected, and the SI Division formally split off on January 1, 1979.

ULVAC COATING later established a local subsidiary in Taiwan. It is currently planning to establish another local subsidiary in China to manufacture mask blanks.