

Development of High Speed Color Negative Films and New Concept One-Time-Use Camera “Utsu-rune-desu Night & Day”

*Yoichi Maruyama, Masayoshi Toyoda, Norihiro Omae, Yuji Mikami and Yoichi Suga
Fuji Photo Film Co., Ltd. Imaging Materials Research Lab.
210 Nakanuma, Minami-Ashigara, Kanagawa, 250-0193, Japan*

Abstract

In March 2003 Fuji Photo Film proudly announced the new SUPERIA X-TRA 400 and the new SUPERIA 1600 35mm films and new concepts One-time-use camera “Utsu-rune-desu Night & Day” in Japan market. These new films have realized superb image quality and faithful color reproduction by Utilizing Fuji’s technologies such as proprietary Nano Structured Σ (sigma) grain Technology, Super Efficient Coupler Technology and fourth color layer technology. One-time-use-camera “Utsu-rune-desu Night & Day” is equipped with new SUPERIA 1600, a shutter speed change mechanism and the brightest lens among one-time-use cameras. These new technologies provide “Utsu-rune-desu Night & Day” with vastly improved capacity to render background details that have been hard to capture with one-time-use cameras until now. When used in night scenes or dimly lit rooms, this camera produces bright, beautiful images of foreground people as well as the background.

Introduction

In March 2003 Fuji Photo Film proudly announced the new SUPERIA X-TRA 400 and the new SUPERIA 1600 35mm films .

High-speed films have been offered many benefits⁽¹⁾: reducing the impact of camera shake, extending the flash range, improving stop-action photos, improving the depth of field and so on. But there is trade-off relationship between high-speed and image quality.

The new SUPERIA X-TRA 400 and the new SUPERIA 1600 Films have overcome the trade-off relationship by introducing the new developing technology, that is Nano-Structured Σ (sigma) grain Technology and Super Efficient Coupler Technology.

As a result new SUPERIA X-TRA 400 realized expansion of photographic space without spoiling image quality, and the new SUPERIA 1600 realized great advance in image quality.

“Utsu-rune-desu Night & Day ” announced at the same time in Japan market adapted “new SUPERIA 1600 ”, diaphragm and shutter speed changeable mechanism,

introduced for the first time to one-time-use-camera, and brightest lens in the one-time-use camera. These technologies enable us to take pictures which is difficult to take, for example night scene, dark lit rooms and so on.

This paper describes the background of development of new films especially for Venus1600 and “Utsu-rune-desu Night & Day ” and the features of technologies in detail.

Design Concepts

Recently pictures have been easily taken under various situations by compact cameras with reduced size and extended zoom lenses. Figure1 shows the result of the opinion from many compact camera users. For the question of “What is the good picture?”, people answered, “Picture without motion blur, bright pictures, and fine pictures of night scene” etc. Namely, people want to take pictures of moving subject without blurring and night scenes brightly.

Figure2 shows the result of frequency distribution of picture taking for the typical compact cameras.

Most photographic space can be covered by using ISO1600 films. Therefore it is considered that the regular use of iso1600 film is needed for consumer. But the 1600 film is not regular use because it has been considered to be insufficient image quality. So the target of iso1600 film was to improve the equal image quality of regular use films.

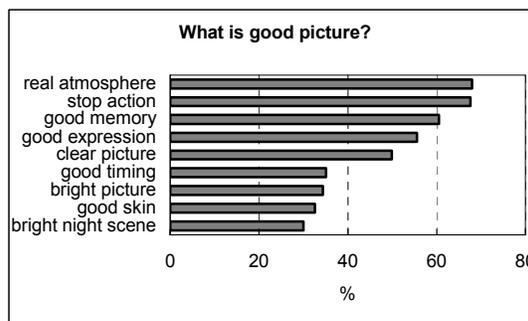


Figure 1 The result of opinion of many compact camera users.

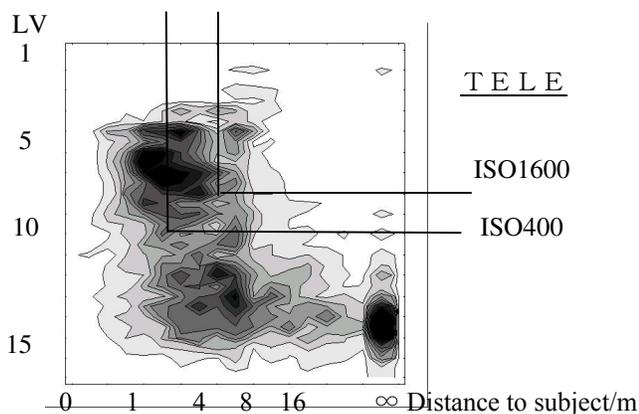


Figure 2 Photographic-space and contour map of frequency distribution of picture taking for the typical zoom compact cameras.

On the other hand one-time-use-camera “Utsu-rune-desu Night & Day” have been used for many people since 1986 releasing. The No.1 answer of the users survey of one-time-use cameras, is to take pictures of night scene. So the target of new one-time-use cameras is decided to the one which can be able to take pictures of night scene that have been hard to capture until now.

Features of New Films

I Excellent granularity and sharpness

The important factor for determining image quality of high-speed film is granularity and sharpness. The introduction of Nano-Structured Σ (sigma) grain Technology realized excellent granularity of the new SUPERIA 1600 film almost equal to that of ISO800 films. And adoption of Super Efficient Coupler Technology improved sharpness. Therefore it is enough image quality for general use in the indoor and in night scene.

II Superior Resistance to Natural Radiant Rays

The granularity is changing worse suffering natural radiant rays. So the maintaining of fresh granularity is important problem for high-speed films. It is known that speed for natural radiant rays is related to the amount of coating silver and volume of grain. Introducing Nano-Structured Σ (sigma) grain Technology made possible to reduce the amount of coating silver and grain volume, so the strong resistance to natural radiant rays has realized. So it has enough confidence for regular use film.

III Faithful color reproduction

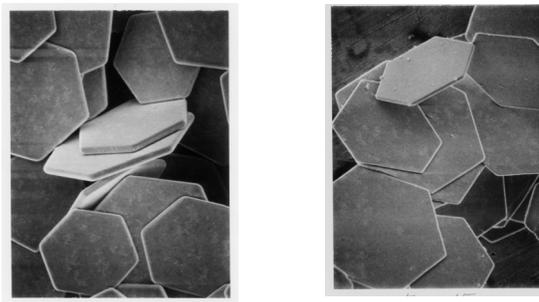
The Fujifilm's proprietary 4th Color Layer Technology is also introduced to the new films. This technology enables faithful and vivid color reproduction even under fluorescent lighting.

Technologies of New Films

I Nano-Structured Σ (sigma) grain Technology

Usually there is a trade-off relationship between speed and granularity both related to grain size. So the new technology for high speed without enlarging grain size is needed for improvement of image quality. Nano-Structured Σ (sigma) grain overcame this subject by raising efficiency of light absorption per volume and efficiency of latent image formation. Raising the aspect ratio (the ratio of diameter and thickness of tabular grain) of grain is effective means for raising efficiency of light absorption. We have succeeded to grow dominant lateral growth of tabular grain by analyzing the growth mechanism of tabular grain. On the other hand introduction of edge dislocation is effective for preventing recombination of electron and dye hole. The dislocation acts as temporary electron trap to prevent recombination of electron and dye hole. The temporary electron trap is also improved in Nano-Structured Σ (sigma) grain, and high efficiency of latent image formation has attained.

This technology reduces about 40% of the thickness of tabular grain compared with the former type tabular grain (Figure 3). This technology realized the best granularity of the new SUPERIA 1600 film in iso1600 films, and reduces the change of granularity owing to natural radiant rays.



Current Grain

Nano-Structuerd Σ grain

Figure 3 The comparison in shape between current and Nano-Structuerd Σ grain.

II Super Efficient Coupler Technology

The sharpness is important factor for image quality. But the sharpness deteriorates by light scattering causing reflection from grains, and long light path in the emulsion layer and so on. If we reduce the thickness of the emulsion layer, we can improve the sharpness.

New Super Efficient Coupler Technology⁽²⁾⁻⁽⁴⁾ boosts color development efficiency and color dye generation. This technology enables us to reduce the thickness of blue layer, so we can improve sharpness of new films.

III 4th Color Layer Technology

Fujifilm's exclusive 4th Color Layer Technology essentially "sees" color in the same way as the human eye⁽²⁾⁽³⁾⁽⁴⁾. The three color-sensitive layers (red, green and blue) of conventional color film emulsion have difficulty in accurately responding to certain hues, especially in the green end of the spectrum. Fujifilm's proprietary 4th Color Layer Technology produces exceptionally faithful color through the entire color spectrum, even under fluorescent lighting.

Features of "Utsu-rune-desu Night & Day"

"Utsu-rune-desu Night & Day" is a high-performance one-time-use camera featuring an additional flash setting called Night Scene Mode. This mode can be used in both bright and dark situations to produce higher image quality than any other current Quick-Snap model.

I Night Scene Mode for Greatly Background Depiction

The following new technologies provide "Utsu-rune-desu Night & Day" with vastly improved capacity to render background details which was difficult to capture with Quick-Snap models until now. When used in night scenes or dimly lit rooms, this camera produces bright, beautiful images of foreground people as well as the background.

i) One-touch Night Scene Mode Switching Mechanism

A one-touch switching mechanism has been newly developed and incorporated as part of the regular flash ON/OFF switch. Switching to Night Scene Mode automatically changes the aperture to F6.2 and shutter speed to 1/45 sec, allowing backgrounds to be captured with high brightness. At the same time, flash visor incorporated in the flash unit pops up to reduce the amount of light striking the main subject. The result is the ability to not only properly expose the subject in the foreground but also capture the background with a high level of brightness. (The aperture and shutter speed when the regular flash is ON or OFF are F14 and 1/120 sec, respectively.)

ii) Newly Developed Bright Two-element Plastic Lens (F6.2)

At F6.2, the newly developed high-performance, two-element lens incorporated into this camera is the brightest among one-time-use cameras. Thanks to its two-element construction, the lens renders peripheral image areas with enhanced quality.

II High Image Quality during Outdoor Daylight Shooting with Use of Regular Flash

The F14 aperture and 1/120 sec shutter speed during regular flash use allow images to be captured with sharper details in

near scenery as well as far. Moreover, use of the regular flash for main subjects that are shaded or lit from behind produces photos with a balanced illumination on the main subject and background.

This paper describes the design of the new SUPERIA1600 film and "Utsu-rune-desu Night & Day". New ISO1600 film has wiped out the common sense that ISO1600 film should be inferior in image quality. The drastic improvement of these high-speed films owes innovation mainly in new emulsion technology and in new coupler technology. "Utsu-rune-desu Night & Day" using the new ISO1600 film enables us to take pictures at various situations than any other current Quick-Snap models.

The situation around photography is rapidly changing by the widespread of digital still camera. Fuji Photo Film will continue to effort for improving image quality of silver halide photo-materials with unparalleled sensitivity through unrelenting development of technologies in order to provide consumers with fascinating photography.



Figure 4 The comparison between current Quick-Snap and "Utsu-rune-desu Night & Day".

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Biography

Yoichi Maruyama received a master's degree from Tokyo Institute of Technology in 1988 and joined Ashigara Research Laboratories of Fuji Photo Film Co., Ltd. in the same year. He is currently involved in the development of color negative films.