ROLLEI EM Film Type S

Films for Electron Microscopy

1 Characteristic and Application

The ROLLEI EM Type S film is a special film which is optimised for the scientifical application in the electron microscopy (Electron Micrography). He distinguishes himself by a

- high flexibility,
- high sensitivity,
- excellent signal – noise – relation (for the finest grain),
- highest detailed resolution.

As an robust film base material, mechanically and chemically stable, and dimension – containing, practically untearable, polyester becomes used. Thus, an excellent archive security (LE 500) is guaranteed among other things . It was reported from several users, that the ROLLEI EM Type S film, can be used as a substitute with the proven AGFA Scienta 23D56® film, as well as for other known electron microscopy films. Process adaptions are present, if generally, as a rule only, in limited form necessary.

2 Packaging

Format in cm	ROLLEI EM Type S
6,5×9	yes
8,3x10,2	yes

For use improvement of the individual film sheets, the ROLLEI EM Type S, is packed with little dividing sheets. This reduces problems by static electricity charge (flashings), and makes sure, that the individual sheets do not sticking together. Every sheets of the ROLLEI EM film is marked with an indention in the film corner, which is on the top right if the film is looked from the emulsion side.

3 Technical data: Overview

Sensitation	Orthochromatic to 695 nm
Sensibility	Nominal sensitivity ISO 25/15° Actual sensitivity and contrast by developers and developing time, according to the needs of the users, adaptable.
Base material	Polyester, 175 micron, crystal clear
Resolution capacity	over 300 Lp/mm with nominal sensitivity and contrast 1 : 1.000
Processing	under red, 15W darkroom lighting, distance 1,2 meter

4 Storage of unexposed and exposed film materials

It is recommended (as with all photo sensitive materials) not to put the film to direct sunlight, strong heat, or high aerial dampness. With long – term storage, a cold storage is recommendable. With films which were stored cooled, for the acclimatization of the films, it should be waited until normal surrounding temperature, before the film is taken off the packaging, and is put out to the surrounded air, it could come to condensation precipitation.

5 Exposure, sensitivity, contrast

5.1 *General terms*

At the same time, electron – microscopic admissions on conventional photo sensitive materials are made, and how conventional photos, outgoing from the negative, a positive is made, nevertheless, important differences exist between the production of a negative with light and electrons: With the conventional photography, the latent picture on the negative is generated by photons (light particles). So that a silver halogenide crystal becomes developable, it must have been met in the shelve from several, typically, from 5 to 10 photons. Differently, in the case of the electron – microscopy: The picture is generated by electrons. One single electron is surely enough to make developable up to 10 silver halogenide crystals in the emulsion. This difference lies in the different reasonable energy, which transfers a photon and an electron: While the photon transfers in the area of visible light, typically 2 to 3 eV, these are with an electron in an electron microscope from 50 to 100keV, possibly from 25,000 to 35,000 – times! Accordingly, the film material behaves in both cases differently: While the picture noise – accordingly to the graininess are determined in the conventional photography – with conventional films, in the essentials by the size of the crystals in the emulsion, it is determined with electron – microscopic admissions, by statistical fluctuations of the electron beam intensity. It appears, that the real picture signal, the benefit information, increases linearly with increasing exposure. On the other hand, the picture noise increases only with the square root of the exposure. Conclusions arise from it, concerning the optimum image quality, that is called of the best possible signal – noise – relation: If the necessary picture density, and the necessary contrast are reached, by lengthening of the development, because the noise signal is strengthened in the same mass by the development, like the benefit signal. Nevertheless, the statistical fluctuations which are caused by the noise signal, become less significant with communications about a bigger number of electrons. Hence, the use of a bigger number of electrons, arise of the abbot branch rate, leads to a wealth of small details. Another factor with a choice of the exposure, is the loading capacity of the test. With the tests whose (in)stability forbids a longer exposure, a way can consist in the fact, for the increase of the image quality, that the device enlargement (the enlargement is chosen by the electron microscope) will be kept very small, and the necessary final enlargement (actual enlargement in the real picture) is achived on the optical way. The lowering of the device enlargement leads to the fact, that with the same load of the test film surface, more electrons are available. Thus, an final enlargement can be achived, e.g., from a 80 – time, on the other hand by an 80 – time device enlargement, and on the other hand, however, also by a 20 – time device enlargement, and 4 – time optical enlargement of the negative. In the case of a stable test can be arbitrarily long exposed, and the first – called way, would lead to optimum results. In the case of an unsteady test, only for the time to the electron bombardment limits can be put out, nevertheless, a smaller device enlargement, and next optimal post – enlargement would deliver better results. This makes clear, that for the electron microscopy used films, must fulfil other requirements, than conventional photographic materials. In particular, it must be possible, according to the requirements of the test, to achive comparable density and contrast on different ways (weak exposure + rich energy development, or strong exposure, and delaying development).

6 Processing

6.1 *Developers and developing times*

The ROLLEI EM Type S film, can be processed in all kinds of developers. Besides this, films for electron microscopy are developed mainly in hard working developers. ROLLEI HIGH CONTRAST (RHC) and KODAK D – 19 are recommended, but also ILFORD ID – 11 and KODAK D – 76. The following developing times are clue values which are able to do this as starting point for own optimisation. On this basis of capacity in the processing, it can be necessary, to modify this values after your needs as a final user.

Developer	Processing time [min]
ROLLEI High Speed 1+9	5
ROLLEI High Contrast 1+7	4-5
Kodak D-19 1+2	4

6.2 *Stop bath*

The stop bath serves, primarily, to neutralise the film from carried alkali, to prevent reductions of the effectiveness of the fixing bath, by increasing pH factor. The following stop baths are recommended:

Stop bath	Effective time [min]
ROLLEI RCS CITRIN STOP	1
LP-ECOSTOP 1+7	1

If no sour stop bath is used, a in – between soaking is recommended, by 2 x 30 Sec. With 20℃ and constant move-ment to prevent the abduction of developer left overs in the fixing bath.

6.3 *Fixing*

For fixing of the ROLLEI EM Type S film, ROLLEI FIX ACID 1 + 7 is recommended as a modern high – performance fixing bath on Ammoniumthiosulfat basis. The necessary fixing time can be determined by a regulation of the clearing time (fixing time = double clearing time). If none clearing time measurement is carried out, it is recommended a fixing time of 3 minutes with 20℃, with a fresh fixing bath.

6.4 *Soaking*

A inflow temperature of roughly 20℃ is certainly enough. Then soaking of 5 minutes in fluent water is sufficient.

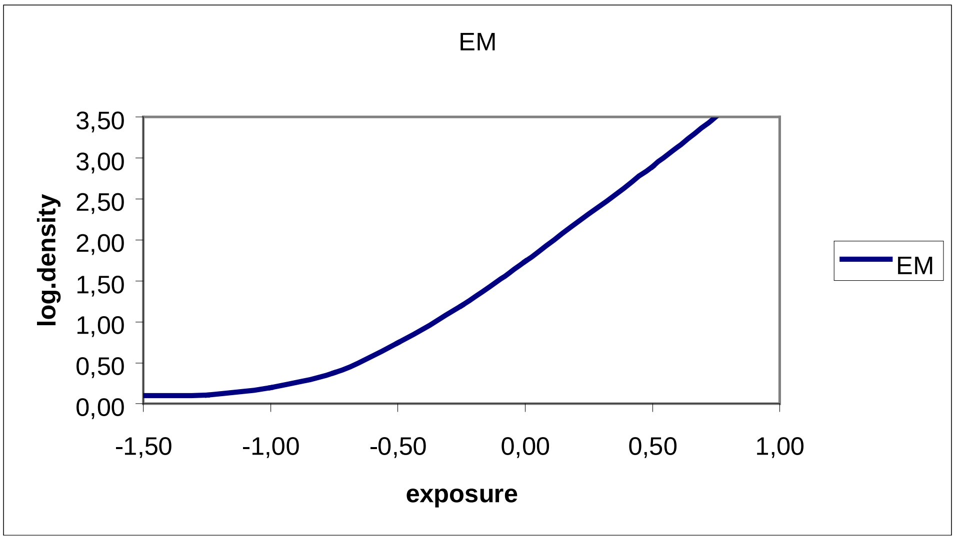
6.5 *Wetting agent*

As a final bath with a wetting agent, set with de-mineralised, de-ionised or destilled water (battery water) are recommended to avoid to dry spots by hardend water, and to avoid static electricity charge of the film material. Static discharge leads to the fact that the film material draws dust particles which become apparent on the positive copies, as white spots annoyingly. The ROLLEI WETTING AGENT 1 + 100 to 1 + 200 is recommended, for one minute without movement (because of the foam development, see below). The wetting agent should not be overdosed. It is suited only for the multiple use, if immediately one after another, several films are processed. Foam runs badly off from the film surface. Hence, a foam development should be avoided while attaching the wetting agent by careful adding into the water.

6.6 *Drying*

Any stripping of water from films is not recommended, because it rescues the danger of scratches. After the wetting agent bath, the water should be removed by shaking the film, to remove the water from the film surface. Hang up the film on a poor dust place for several hours, better overnight, to dry completely. By drying in a drying cabinet, the heating element of such a device, should remain switched off. The drying with a hair dryer is absolutely not recommended, because hair dryers incline, in the absence of dust filters, to blow dust particles onto the film, which stick on the still humid surface of the film, and are hardly to remove without damaging the film.

7 Characteristic curves



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