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ProductInformation

FILM, KODAK X-OMAT

Product Number **F 5263, F 5388, F 5513, Z35,848-7, Z35,849-5, Z35,858-4, F 5763, F 5888, F 5014, F 5138**

Synonyms: Synonyms: XAR-2 (F 5763, F 5888, F 5014), XAR-5 (F 5513, F 5388, F 5263, Z35,848-7, Z35,849-5, Z35,858-4), XAR-351 (F 5138)

Product Description
Kodak X-OMAT is a general-purpose film with emulsion coated on both sides of a clear film base. It is suitable for most autoradiography applications using low-energy or high-energy isotopes. Using an intensifying screen can enhance the signal from high-energy isotopes. X-OMAT is also suitable for chemiluminescence. An intensifying screen will not enhance this signal.

The film supplied under all three film types, XAR-2, XAR-5, and XAR-351, is the same. The difference between the three types is the packaging method. XAR-2 is packaged with each sheet of film in a light-protected envelope, XAR-5 has 50 sheets of film in a single foil envelope, and XAR-351 is a 20 cm x 25 meter roll, which can be cut to the desired length.

Storage/Stability
X-OMAT film may be stored safely at room temperature. As autoradiography film ages, the background, called fogging, slowly increases. This is caused by the oxidation of the silver in the emulsion. Storing at 4 °C can extend the shelf life by slowing the development of background fogging. If the film is stored at 4 °C allow it to warm

Safelight
The GBX-2 Safelight Filter (Product No. F 9515) is recommended for darkroom handling of X-OMAT films. Use a 7.5 Watt frosted bulb in the safelight placed at least four feet from the film handling area.

If the bulb in the safelight is brighter than 7.5 W or the safelight is located too close to the working area it could cause film fogging. To test for fogging by the safelight, remove a small sheet of X-OMAT film from the box in complete darkness. Cover a portion of the film with a solid object. Turn on the safelight for several minutes, corresponding to a period of time that film would be available to the safelight from opening the box to processing. Turn the safelight off and process the film by the usual procedure. If, after processing, an outline of the object can be seen on the film the safelight is fogging the film. To remedy this either use a bulb of lower wattage or place the safelight further from the area where film is handled.

Exposure Procedure
Direct Exposure: The direct exposure method is used for most autoradiography applications. ^{14}C, ^{35}S, and ^{32}P are isotopes commonly used in this technique. The labeled dry sample is placed directly on a sheet of film in an exposure cassette. If the sample is a moist gel place a layer of plastic wrap between the film and sample.

Indirect Exposure: This technique is used for weak energy isotopes, such as ^{3}H. In many samples the emission from these isotopes is quenched before leaving the sample. Impregnating or overlaying the sample with a fluor, such as 2,5-Diphenyloxazole, can enhance the signal (Product No. D 4630) or Sodium Salicylate (Product No. S 3007). The isotope activates the fluor and re-emits the absorbed energy as visible light, which exposes the film. Fluors are usually used with ^{3}H, but can be used with ^{14}C and ^{35}S.

Chemiluminescence: In the process the sample is treated with reagents to perform a series of reactions, resulting in emission of visible light. The light exposes the film.

Preparing for Exposure:
Because most exposures require an extended period of time, the film and sample are placed in an exposure cassette. If no intensifying screen is used simply place the sample on the film in the cassette. If an intensifying screen is used the film should be placed on the screen and the sample placed on the film. The film is sandwiched between the screen and the sample.

Intensifying screens will enhance the signal of strong emitters like ^{32}P. As seen in the diagram, beta particles from the isotope may or may not expose the film as they pass through. An intensifying screen opposite the sample will capture the radiation that passes through and re-emit the energy as visible light, exposing the film. A second screen on the other side of the cassette will not significantly improve the signal. The light generated here would have to pass through the sample to expose the film. If the samples are opaque, like nylon or nitrocellulose membranes, little light would pass through. Even gels that appear to be transparent could distort the light passing through and reduce the resolution of the signal. The energy of weaker isotopes, such as ^{14}C or ^{35}S, is generally not strong enough to pass through the film to activate the screen. An intensifying screen would not significantly improve the signal from these samples.

Exposure Temperature: In the case of weak signals placing the assembled exposure cassette at –70 °C can improve the signal. A silver grain must absorb three photons of energy to be stable. If there is too much time between absorption of the first and third photon, the unstable 1- or 2-photon stage can lose a photon and the exposed state will take longer to stabilize. Placing the film and sample at –70 °C extends the life of the 1- and 2-photon stages allowing more time to capture a third photon. The minimum times needed for this process are not available. This holds only for very weak signals. Strong signals are not significantly improved by exposure at –70 °C because the silver grains can quickly capture the three photons for stability. Users may want to test this in their laboratories.

Processing Procedure

X-OMAT films can be processed manually or in an automated processor.

Automated Processing: See the manual for your instrument for processing instructions. Sigma offers Kodak Processing Chemicals for automated processing:

RP X-OMAT Developer/Replenisher (Product No. Z35,409-0)
RP-X-OMAT LO Fixer/Replenisher (Product No. Z35,410-4)
RP-XOMAT Developer Starter (Product No. Z35,411-2)
Developer System Cleaner (Product No. Z35,412-0)
Fixer/Wash System Cleaner (Product No. Z35,413-9)

Manual Processing: There are two different methods of manual processing, tray or deep tank. The only differences between the two methods are the volume of processing chemicals and the vessels used.

The tray method employs three trays that are at least 2-3 cm longer and wider than the film to be processed. One tray is for development, one for washing between development and fixing, and one for fixing. The film is moved from one tray to the other with print tongs.

The deep tank method generally uses two or three 5-gallon tanks in a water bath to regulate the temperature of the solutions. The film is placed on film hangers to move it from one tank to the next.

Processing times are the same in either processing method. The recommended processing temperature for development is 20 °C. For rinsing, fixing and washing should be 16-24 °C. The temperature of all solutions should be close to the same. Extreme differences can damage the film emulsion. Processing times and temperatures should always be constant in the process. If a different signal strength is desired, vary the exposure time for the film.

Development: Place the film in GBX Developer/Replenisher (Product No. P 7042) for 5 minutes with moderate agitation for 5 seconds every 60 seconds. Gently rocking the tray or moving the film hanger up and down in the deep tank method accomplishes agitation. The developer should be replenished at a rate of 60 ml Developer/Replenisher for every 35 x 43 cm sheet of film processed in tray or tank.

Rinsing: Rinse in Kodak Indicator Stop Bath (P 7292) or running water for 30 seconds with moderate constant agitation.

Fixing: Place the film in GBX Fixer/Replenisher (Product No. P 7167) for 5-10 minutes with moderate agitation for 5 seconds every 60 seconds. The fixer should be replenished at a rate of 75 ml Fixer/Replenisher for every 35 x 43 cm sheet of film processed in tray or tank.

Wash: Place film in running water, with a change rate of 8 volumes/hour, 5-10 minutes.

Dry: Hang in a dust-free area to air dry. An optional post-wash rinse in Photo-Flo 200 (Product No. P 7417) for 30 seconds before drying allows the film to dry essentially spot free.

Notes:

1. As the developer is used it will become yellow. This is normal. The developing process is an oxidation-reduction reaction. Exposure to air over time will also result in a yellow solution. If the developer becomes too yellow it will have lost much of its developing capacity. If the developer is used infrequently, storing it in a tightly capped bottle can extend the life of the developer. Replacing the bottle headspace with an inert gas, such as nitrogen, is even better.

2. As fixer is used and ages it can form a precipitate. If the amount of precipitate is small, decant and use the supernatant.

3. The purpose of the fixer is to remove unexposed silver from the emulsion. If, after the normal fixing time, the film still seems to have a film of emulsion remaining, place the film back in fresh fixer for about 5 minutes to complete the fixing process. Do not be concerned if this has been observed in room light. The film will not fog if only the fixing process is performed.

References

Autoradiographic Detection Principles. Kodak Bulletin SI-100. Copyright 1/93.

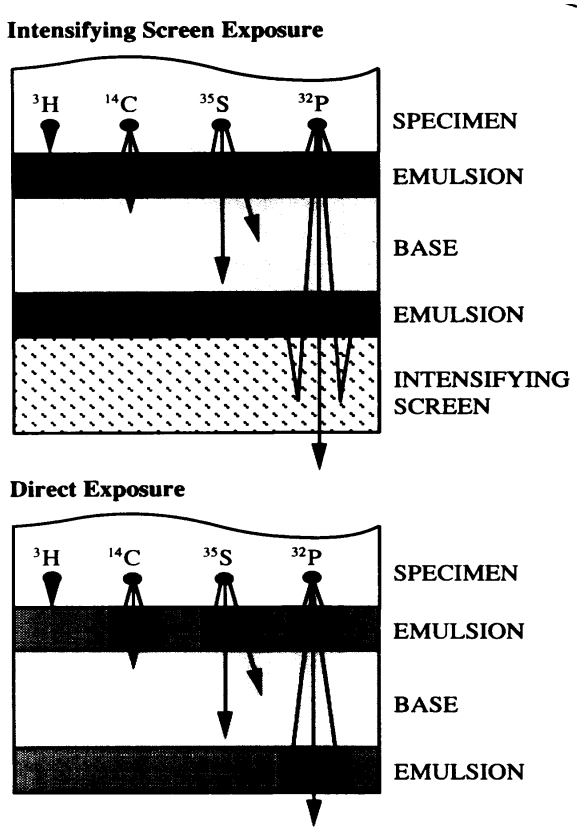

Figure 11. Illustration of Penetration of Radiation into X-ray Film.

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