FAQ
ILFORD NUCLEAR EMULSIONS

FREQUENTLY ASKED QUESTIONS ABOUT PARTICLE PHYSICS

1 PRODUCT RANGE

1.1 What products are suitable for Particle Physics?

ILFORD supply 4 emulsions suitable for Particle Physics. These are as follows.

ILFORD emulsion	Crystal diameter (μm)	Comments
K0	0.20	Used in particle physics to record protons of energies up to 5MeV.
K2	0.20	Records protons to about 80 MeV.Slow electrons produce tracks of a few grains only.
K5	0.20	Exposure times tend to be shorter than with K2, especially where activity levels are low.
G5	0.27	Sensitive to minimum ionising particles

A further range of emulsions is under development for particle physics experiments. These will be even more sensitive to minimum ionising particles than G5 emulsion. Preliminary samples can be made available by arrangement.

1.2 How is the product supplied?

ILFORD nuclear emulsions are routinely supplied in brown glass bottles of 50 and 100ml. These products are available from stock at the manufacturing site in Mobberley, UK.

Larger volume units can be made available on request.

1.3 Are these emulsions available coated onto a substrate?

If a coating of emulsion onto glass is required this can be done by ILFORD. Coating onto other substrates will also be considered. Please enquire about feasibility and price. Email us

1.4 Are pellicles available?

Pellicles are thick layers of emulsion cast without a substrate. These can be made at various thicknesses from any of the above emulsions. Please enquire about delivery time and price.

For general queries on supply, pricing and availability please contact ILFORD.

2 PRODUCT USE

2.1 How should I store the product before use?

In general, nuclear emulsions should be protected from light and local radioactivity. They should be kept under refrigeration below 5°C but without freezing.

2.2 What is the shelf life of the emulsion?

If correctly stored, nuclear emulsions should remain in good condition for at least two months. As the product ages with time or inadequate storage conditions the background tends to rise. Nuclear emulsions may be usable for considerably longer depending on the level of background acceptable in a particular application.

2.3 How can I tell if the product is still usable?

The most important parameter to check is that the background has not risen to unacceptable levels. This should be tested before commencing an experiment. Coat a sample and process as usual. If the level of background is acceptable and the distribution of developed grains is uniform, the emulsion is undamaged and fit to use.

The emulsion is dispatched as shreds that can normally be removed from the bottle with plastic tweezers. However, it is possible that ILFORD nuclear emulsion may have been exposed in transit to conditions causing the shreds to melt slightly and form a solid lump. These conditions may not have affected the performance of the emulsion.

2.4 How do I melt the emulsion for use?

Remove enough emulsion from the bottle for immediate requirements only. Melt in a glass or stainless steel vessel in a water bath at about 40°C, stirring gently to avoid local overheating. Additional water may be added to decrease the viscosity.

2.5 What safelight should I use?

For general darkroom illumination, the ILFORD 902 (light brown) safelight filter in a darkroom lamp fitted with a 15 watt bulb, is recommended. For direct illumination, the ILFORD 904 (dark brown) safelight filter is recommended. When maximum illumination is required, a sodium lamp with the correct safelight filters may be used.

2.6 How should I store the product during exposure?

After coating and drying, samples may be stored at room temperature, refrigerated or frozen. When samples are stored below 5°C and are to be used at normal room temperature, they should be allowed to warm up in their packaging to prevent condensation forming on the surface.

3 PROCESSING

This is the single biggest cause of problems using these products.

3.1 What developer should I use?

The method of developing ILFORD Nuclear emulsions and the choice of developer is largely determined by the thickness of the emulsion layer. This is because the time taken for the developer to diffuse through the layer should be an insignificant fraction of the total development time. If this were not the case development would be uneven through the layer.

This is discussed further in the Technical Information sheet.

Always ensure the developer is fresh.

3.2 Should I use a stop bath between development and fixing?

In general this is a good idea. This may be made up with ILFORD ILFOSTOP PRO diluted 1+19 with water or 0.2-2% acetic acid solution. This will reduce the incidence of surface staining of the emulsion layer after processing (dichroic fog).

3.3 What fixer should I use?

Use a non-hardening fixer, e.g. ILFORD HYPAM diluted 1+4. Hardening fixers are not recommended because of the difficulty of ensuring an efficient wash.

Fix the material for twice the time it takes the emulsion to clear.

3.4 How should I wash the emulsion after fixing?

Samples may be washed in tap water, but give a final rinse in distilled water. This will ensure that any materials dissolved in the tap water are not concentrated in the emulsion on drying. Failing to do this is a common cause for a lack of permanence in the final image.

4 CURES FOR FOGGING OR HIGH BACKGROUND

There are a number of possible causes for an increase in background density. The common ones are listed below.

4.1 Extraneous light

It is worthwhile checking that the darkroom area is indeed light tight. The best way to do this is to turn off all the lights in the darkroom and look for light leaking in after your eyes have adjusted to the darkness for around 30 minutes.

4.2 Safelight problems

Check that the safelight filters are of the correct type and the correct wattage of bulb is fitted. Also check that no unfiltered light can leak out of the casing and that the safelight filter is free of defects such as cracks or scratches.

Nuclear emulsion should not be exposed to safelighting for any longer than necessary.

4.3 Changes in temperature during processing

Sudden temperature swings of around 10°C whilst wet can cause a defect known as reticulation. On a macroscopic level this causes a roughening of the emulsion surface similar to orange peel. On a microscopic scale there are large local changes to the fog level due to stresses and strains within the emulsion.

4.4 Contamination by chemical vapours.

Sensitised materials should not be stored near to certain chemical solutions, such as ammonia, sodium sulphide or formaldehyde; or near fumes or vapours coming from volatile substances; gases, such as sulphur dioxide or coal gas; or some industrial solvents and cleaning fluids. Materials should not be stored on new or newly painted wood.

Processing chemicals should be stored as far away as possible from the emulsion.

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