

# SM001 METHOD FOR ASSESSING THERESIN DISPERSION IN PVC PIPES

ISSUE 01 / 11 NOVEMBER 2003

## Scope

This procedure describes a method for assessing the level of dispersion of the resin in PVC pipes. The method is applicable to PVC-U, PVC-M and PVC-O pipes for pressure applications.

## Purpose

It has been established that the toughness of PVC, as demonstrated by resistance to slow crack growth, is dependent upon the level of gelation. The extent to which residual PVC grain structure is evident in a pipe wall is one of the indicators of the level of gelation.

Note: The method can be applied to samples taken as the extrudate exits the die at the start of a production run. Assessment of the dispersion can therefore be completed before any pipe is actually produced.

## Apparatus

### Microtome

- A rotary microtome capable of cutting sections of PVC 10 - 20 $\mu$ m thick.
- A microscope having a magnification in the range of 32x to 40x. Both transmitted and incident light sources are permitted for viewing the specimens.

## Preparation of the Specimens

- 1.1. Cut a small piece of pipe suitable for clamping in the microtome. Ensure the sample includes the full wall thickness of the pipe.
- 1.2. Mount the piece of pipe in the microtome and clamp firmly.
- 1.3. Proceed to microtome sections approximately 10 - 20 $\mu$ m thick from the piece of pipe. These sections shall be cut through the full wall thickness of the pipe. They may be cut in either the direction of extrusion or at right angles to the extrusion direction.

Note: Whilst the assessment can equally be performed on sections cut in either direction, it is preferable to standardise on one direction for routine assessments.

- 1.4 Take a complete section across the full wall thickness and place on a microscope slide. Cover with another slide or cover slip.

## Examination

- 1.1 Place the specimen on the microscope stage and illuminate with either incident or transmitted light.
- 1.2 Examine the specimen at a magnification in the range of 32x to 40x. If the section is too large to fit in one field of view, locate the area of poorest dispersion.
- 1.3 Compare the dispersion of the microtomed section with the standard photographs [Appendix A] showing poor and complete dispersion and apply a rating.

## Interpretation

- 1.1 A pipe with a dispersion equal to photograph of the poor sample is considered to be under-processed.
- 1.2 Specimens with a dispersion rating between 'poor' and 'complete' shall be rated on the basis of a correlation, established by in-house experience, between dispersion and mechanical properties such as impact resistance or fracture toughness.

Note: A dispersion rating poorer than 'complete' does not mean the pipe is not fit for purpose or will fail any of the product Standard tests. However, as a sample approaches the 'poor' example it should be viewed as a warning sign that more detailed examination of the pipe quality is warranted.

## Report

The following information shall be reported.

- Nominal diameter, DN
- Pressure classification, PN
- Date of manufacture
- Material (PVC-U, PVC-M or PVC-O)
- Dispersion Rating in accordance with the 'in-house' procedure.

## Appendix A Dispersion Images

### COMPLETE DISPERSION

Transmitted Light



Reflected Light



### POOR DISPERSION

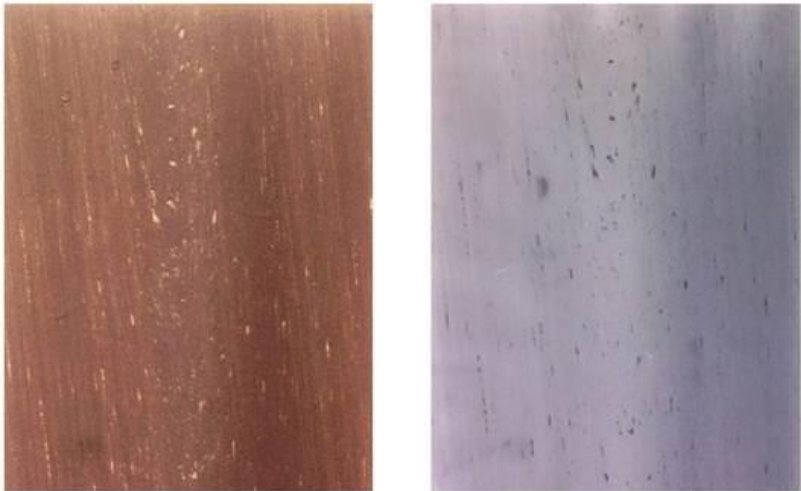
Transmitted Light



Reflected Light



Microtomed samples cut perpendicular to the direction of material flow Microtomed samples cut through the thickness of the pipe wall and parallel to the direction of material flow.





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