

Dichloromethane Testing





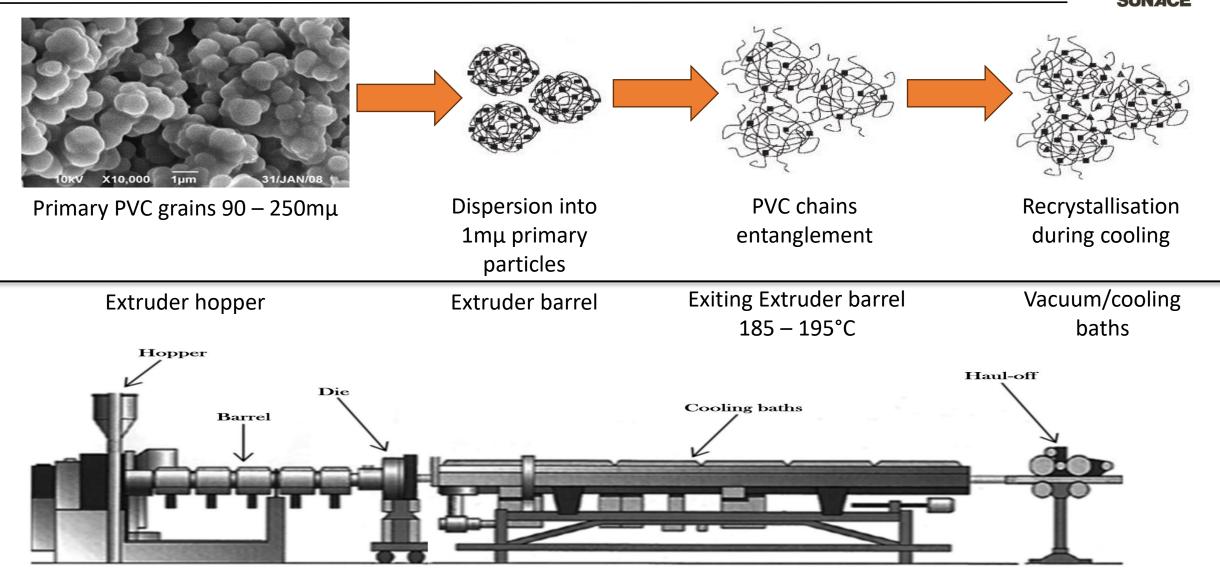


- Dichloromethane Testing (DCMT) has been used for a long time to measure the level of gelation in rigid PVC extrudates
- •The test method most widely used is ISO 9852:2007. This standard was reviewed in 2023 and remains current
- •ISO and EN standards use the test method to determine the highest temperature where no attack occurs.
- •SANS (South African National Standards) use the same test method to determine the percentage attack at 20° Celsius reagent temperature.
- •We will look at the difference between these tests and their benefits and shortcomings.



How Gelation is Achieved



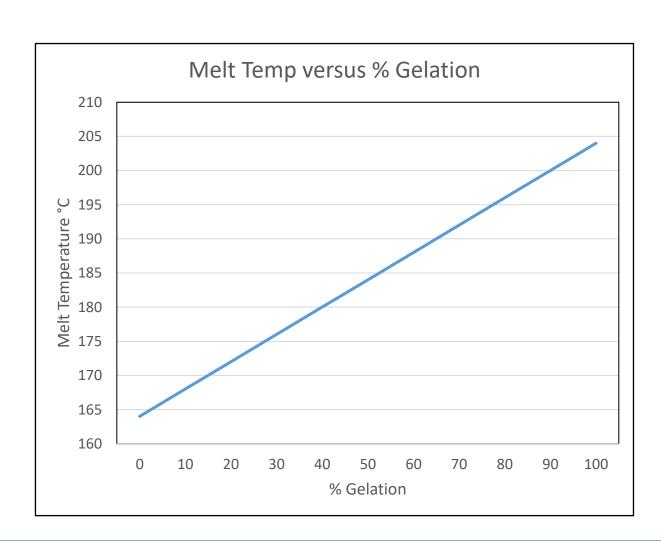




Melt Temperature and Gelation Level



- Gelation is related to the melt temperature achieved during processing
- Heat and shear improves gelation and changes physical properties
- •It is important to note that poor gelation may not always affect the short-term properties, but WILL affect the long-term properties of a pipe

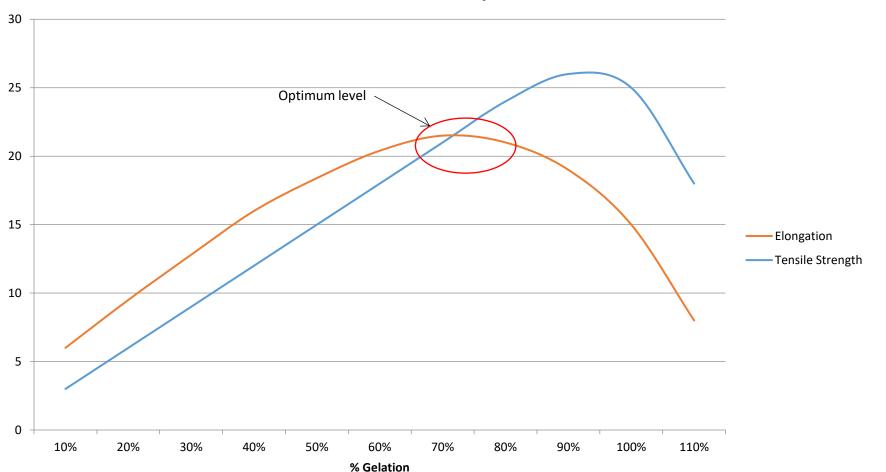




The Significance of Gelation







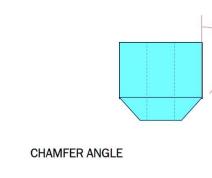
- As gelation level increases the PVC changes from a rubbery to glassy state
- Low gelation level results in good ductility, but poor strength
- Very high gelation results in high strength, but brittleness
- Gelation level is best where both the strength and ductility are adequate



ISO Method of Measuring DCM

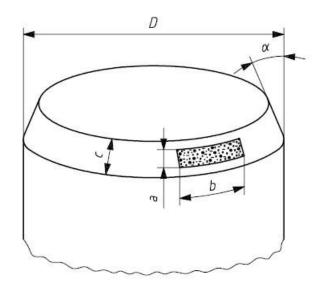


 The ISO method involves chamfering the sample through 90% of its wall thickness to an angle determined by wall thickness and immersing the sample in dichloromethane at 15° C for 30 minutes.



ngle α	
Wall thickness 'e'	Angle α
e ≤ 8	10°
8 ≤ e ≤ 16	20°
e ≥ 16	30°
	A

- Time and temperature is carefully controlled, as both influence the result.
- The sample passes the test if no attack (whitening) of the immersed section is observed.





SANS Method of Measuring DCM



- Samples tested to the SANS method is prepared in the same way as for the ISO method, but the sample is immersed in dichloromethane at 20° C for 30 minutes.
- Time and temperature is carefully controlled, as both influence the result.
- The sample passes the test if no more than 30% of the chamfer contains attack (whitening). No attack is allowed on the inner and outer pipe surfaces.

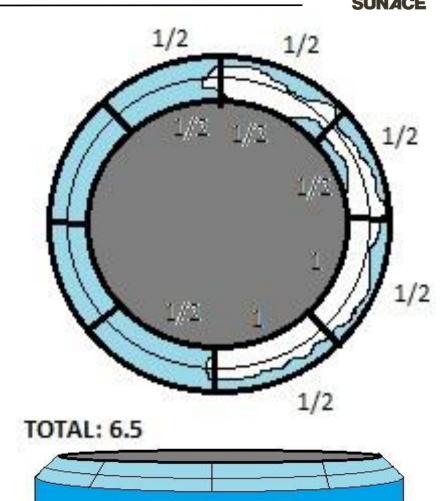




Determining Percentage Attack



- Perform the DCM test and let the sample dry completely
- With a "koki" pen, divide the chamfer in 16 blocks, as illustrated.
- Blocks are marked with "0" for no attack, "½" for partial attack, or "1" for full attack.
- Marks are added up and divided by the number of blocks (16) x 100 to give percentage attack.
- For thick wall pipes the chamfer can be divided into 24 blocks, allowing more accuracy.





Advantages and disadvantages



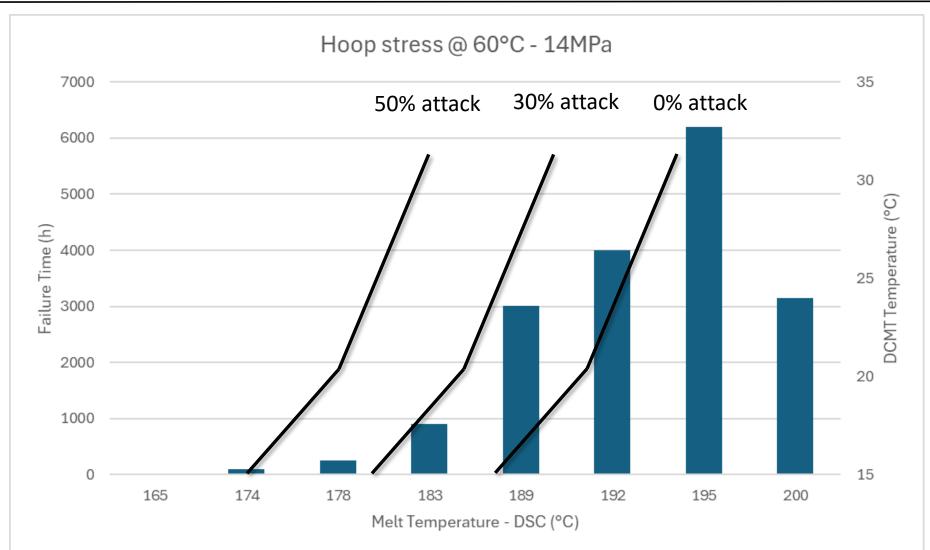
ISO Method @ 15°C	SANS method @ 20°C
Can observe minimum gelation level	Can observe minimum gelation level
Cannot observe excessive gelation level	Can observe excessive gelation level to some extent
No need to measure attack	Attack must be measured as a percentage of the total chamfer area
Cannot observe attack patterns / symmetry	Can observe attack patterns / symmetry as long as attack is visible





DCMT versus Pipe Performance



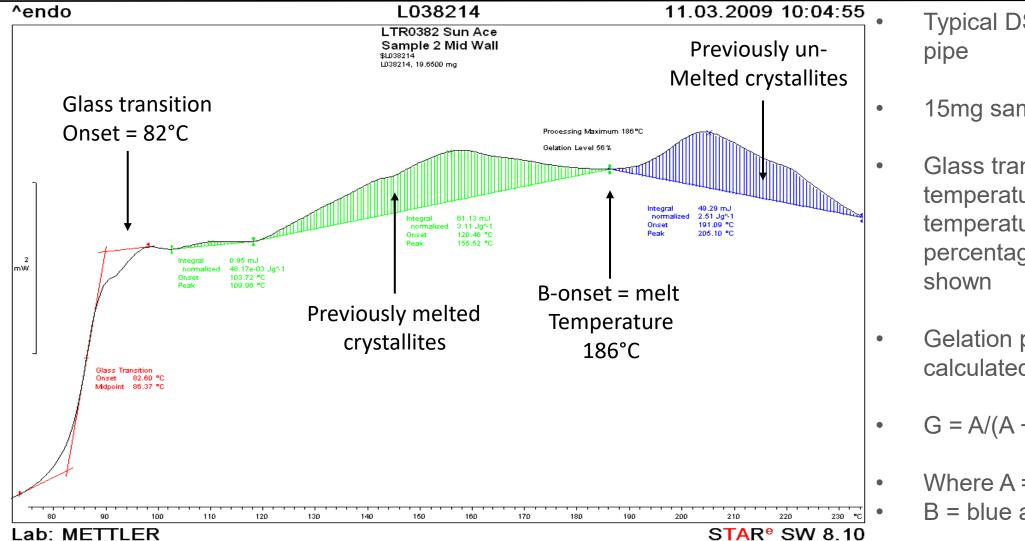


- Best hoop stress (HS Pressure) achieved
 @ 195° C melt temperature
- It should be noted that testing at 15° C and finding 0% attack may mean that the pipe is overprocessed. The test will not show this.
- Testing at 20° C and aiming for slight attack (<5%) will guard against overprocessing



Differential Scanning Calorimetry (DSC)





- Typical DSC result for PVC
- 15mg sample is tested
- Glass transition temperature, melt temperature and percentage gelation are
- Gelation percentage is calculated by:
- $G = A/(A + B) \times 100$
- Where A = green area
- B = blue area



Advantages and disadvantages



DCMT	DSC
Able to test large samples in a single test	Able to test inner, middle and outer wall separately
Test duration 30 minutes	Test duration 2 hours
Cannot highlight over-processed pipe	Can highlight over-processed pipe
Cheap equipment	Expensive equipment
Can see patterns in gelation in a pipe sample	Cannot see patterns in gelation as sample size is tiny (15mg)
Health concerns raised in some countries	No health concerns raised







Thank You For Listening





