

METHOD OF DETERMINING THE UNDERCURE OF HYDROGENATED NITRILE RUBBER IMPREGNATING THE FACING FABRIC OF TOOTHED TIMING BELTS**Application**

The Hydrogenated Nitrile Rubber (HNBR) used to impregnate the polyamide facing fabric covering the tooth profile of HNBR toothed timing belts is susceptible to under-curing during manufacture due to factors as yet unknown. This causes the rubber to be transferred to the surfaces of driving and driven pulleys leading to a build-up of material. This manifests itself as noisy running and increased wear due to tooth misengagement in the pulleys. HNBR contains additives with carbonyl groups in their chemical composition which are constant for a given HNBR compound whether it is under-cured or not. These additives can be extracted from the HNBR by acetone and subsequent infrared spectroscopic analysis of the extract will show the presence of carbonyl groups at approximately 5.8 microns. If the HNBR is fully cured, there should be no nitrile groups from the rubber in the acetone extract. Thus by measuring the ratio of the infrared peaks attributable to carbonyl groups at 5.8 microns and nitrile groups from under-cured HNBR at 4.4 microns, an assessment of the degree of under-cure of the HNBR can be made.

Apparatus Required**Round Bottom Flasks**

250 mL with ground glass joint.

Sohxlet Extraction Apparatus

With ground glass joint to fit the round bottom flask.

Hot Plate, Heating Block or Other Means of Heating

Suitable for heating the round bottom flask with the Soxhlet extractor to reflux the solvent.

Water Bath or Evaporator

To remove solvent.

Vacuum Oven (60 C/0.1 mm Hg)

To dry extracts.

Amber Glass Vial with PTFE Faced Septum - 2 mL

Date	Action	Revisions
2001 09 24	Revised	Editorial – no technical change A. Cockman
1994 08 03		

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Roller Mixer

Glass Syringe - 250 microlitres

Infrared Spectrophotometer

Demountable KBr or NaCl Cell

Acetone

Analytical reagent grade.

Chloroform

Analytical reagent grade.

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

Procedure

1. Peel a length of outer fabric from the belt without the aid of solvent to soften the rubber.
2. Place approximately 1.0 to 1.5 grams of fabric in a sohxlet extraction thimble and extract 4 times with fresh 200 mL portions of acetone refluxed for 4 hours each until complete extraction has taken place. (Place glass antibumping granules in the bottom of the flask.)
3. After extraction, evaporate the acetone from each flask over a water bath to leave the extracted residue from the rubber/fabric sample.
4. Dry each extract in the flask in a vacuum oven at 60 °C, 0.1 mm Hg for at least 30 minutes.
5. Redissolve the extracts with chloroform and combine them. Concentrate the combined extract by evaporation to approximately 0.5 mL.
6. Transfer the chloroform solution to a 2 mL amber glass vial fitted with a PTFE faced septum.