INDIAN RUBBER INSTITUTE

DIRI EXAMINATION – 2010

Paper – II

Date : 29th June 2010 **Time : 14.00 – 17.00 hrs.**
Duration : 3 Hours **Full Marks : 100**

Rubber Processing Technology and Process Engineering

Answers should be illustrated with sketches wherever helpful
Question number 1 is compulsory. Answer **four** from the remaining questions taking **two** from each group

GROUP – A

1. Choose the correct answer from the given alternatives:

(i) Calender rolls are usually made of :
(a) Alloy steel (b) Carbon steel
(c) Chilled cast iron (d) Grey cast iron

(ii) In Mooney Viscometer the rotors are designed as L and S, which stands for :
(a) Long and short (b) Low and slow
(c) Large and small (d) None of the above

(iii) PCI process is associated with the manufacturing of :
(a) Tyre (b) Conveyor belts
(c) Rubber to metal bonded component (d) None of the above

(iv) Excessive milling of SBR compound may lead to :
(a) Softening (b) Gelling
(c) High tack (d) None of the above

(v) Screw mark is associated with :
(a) Calendering (b) Open steam cure (c) Extrusion (d) Press Moulding

(vi) The fill factor in a Banbury mixer for curative mixing is :
(a) 50 – 55 (b) 60 – 65 (c) 70 – 75 (d) 80 -85

(vii) Torque is defined as a product of :
(a) Multiplying force and distance
(b) Multiplying pressure and area
(c) Multiplying area and distance
(d) Multiplying force and pressure

(viii) Microwave heating system is effective for :
(a) Peroxide crosslinked NR
(b) Rubber with metal inserts
(c) Polar rubbers and ingredients
(d) Non polar rubbers and ingredients

(ix) Green strength of an uncured rubber compound is the :
(a) Ability to show ozone resistance
(b) Lack of tack
(c) Loss of physical properties
(d) Ability to maintain stability

(x) Silicone emulsions are used as :
(a) Mould release agent
(b) Reinforcing agent in silica filled compound
(c) Emulsifying agent in emulsion polymerization
(d) None of the above

(xi) RFL dipping on textile fabric is done to :
(a) Improve tensile strength of fabric
(b) Improve tensile strength of rubber compound
(c) Improve adhesion strength between rubber and fabric
(d) Improve flowability of rubber compound

(xii) Mastication of rubber is the process of
(a) Cutting the bales in smaller pieces
(b) Sheeting out the rubber
(c) Reducing the chain length
(d) Extruding the rubber through a die

(xiii) In Hot feed extruders, L/D ratio is :
(a) 2 : 1 (b) 6 : 1 (c) 15 : 1 (d) 20 : 1

(xiv) The term dough is associated with :
(a) Calendering
(b) Extrusion
(c) Mixing
(d) Spreading

(xv) The batch weight capacity of 28" x 84" mixing mill (if sp. Gravity is considered as 1)
(a) 56 – 70 kgs.
(b) 65 – 85 kgs.
(c) 100 – 135 kgs.
(d) 80 kgs. maximum

(xvi) A thick rubber sheeting with profile is produced by using :
(a) Simple calendar
(b) Any hot feed extruder
(c) Spreader
(d) Extruders with roller head die arrangement.

(xvii) Mastication of favoured in the presence of :
(a) Peptizers
(b) Antioxidants
(c) Antiozonant
(d) Electron donating groups in the structure

(xviii) The preferred friction ratio for the NR compound mixing mill
(a) 1 : 1
(b) 1 : 1.2
(c) 1 : 1.3
(d) 1 : 1.5

(xix) In a pin vented cold feed extruder the pins are provided for
(a) Flow of mix
(b) Better homogeneity of mix
(c) Smooth finish of extrudate
(d) None of the above

(xx) ML_{1+4} @ 100^0C is related to the following polymer
(a) NR
(b) Polyethylene
(c) IIR
(d) Polypropylene

20 x 1 = 20

2. (a) **Give reasons (Answer any 5 questions)**

(i) Effect of "Crow's feet" in a calendared fabric.

(ii) Steam curing is more popular in rubber moulding.

(iii) Thick rubber articles cured at low temperature for longer duration.

(iv) Steam trap is required in curing presses.

(v) Cold feed extruder is preferred than hot feed extruder for rubber extrusion.

(vi) Rubber article will tend to loose its tackiness during winter season.

(vii) Sometimes "Porosity" defect is seen in the extruded product.

5 x 2 = 10

(b) **State TRUE or FALSE**

(i) EPDM is not affected by ozone.

(ii) Compression moulding will be normally associated with short cycle time with high temperature.

(iii) Oscillating disc rheometer (ODR) is not used to measure cure time of a rubber compound.

(iv) "Die swell" is associated with moulding operation.

(v) In a strainer extruder a pack of screen/ mesh is used to remove the foreign particle in the rubber compound.

(vi) Mastication is the first process of natural rubber compound.

(vii) Excessive re-milling of SBR compound will lead to "Gelling".

(viii) T_c 90 is generally mentioned for optimum cure time.

(ix) Ammeter is used to measure stock temperature inside the Banbury.

(x) As the moulding temperature increases the mould shrinkage also increases.

1x 10 = 10

3. (a) Sketch a typical rubber extruder showing its different parts.
(b) Discuss the differences between a rubber extruder and a plastic extruder.
(c) What are the advantages of pin barrel cold feed extruder over conventional cold feed extruder?
(d) What is die swell? Explain the factors on which die swell depends.

(6+5+4+5) = 20

4. (a) What are the advantages and disadvantages of a Moving Die Rheometer (MDR) over an Oscillating Disc Rheometer (ODR).
(b) Draw a typical curve for a rheometer and explain the different terms associated with it.
(c) What is Initial Plasticity Number and Plasticity Retention Index? Explain the significance of both terms in rubber industry.
(d) Sketch and explain a Mooney curve.

(5+5+5+5)=20

GROUP – B

5. (a) What are the advantages & disadvantages in compression and injection moulding process?
(b) Explain the method used for vulcanizing the following products:
(i) Tyre curing
(ii) Tube curing
(iii) Hand gloves
(iv) Bus-window channel

(v) Rubber band
(vi) Ballons
(vii) Tennis ball

(c) State the probable reasons for the following moulding problems :
(i) Air entrapment
(ii) Blister
(iii) Porosity at center
(iv) Tearing
(v) Blooming
(vi) Flow cracks
(vii) Sticking to moulds.

(6 +7 +7) = 20

6. (a) Explain the safety factors associated while mixing in a two roll mill with respect to :(i) Machine safety (ii) Human safety
(b) Define the following terms:
(i) Work
(ii) Power
(iii) Energy
(iv) Efficiency
(c) Draw a power consumption – time curve for an internal mixer and discuss the reasons for variation of power with time.
(d) Discuss the drive system of a two roll mill.

(6+4+5+5)= 20

7. (a) Sketch and explain various roll arrangements of calendars.
(b) Explain the various methods to be adopted for obtaining uniform thickness in calendaring.
(c) Explain spreading operation with a diagram.
(d) Explain the reasons for scorching and stock blister in calendaring.

(5+6+5+4) = 20

8. Write short notes on any **Four** of the following :

(i) Rotocuring
(ii) Ram and Screw Extruder
(iii) Steam versus Electrical heating
(iv) Mastication
(v) Mould shrinkage
(vi) Mould release agents.

4 x 5 = 20